

NOV. 1975 75 CENTS

Popular Mechanics

**12 quick fixups
to cheer up**

**your home
for the
holidays**

**How to strip
old furniture
down to new**

**VW RABBIT: Exclusive
1½-million-mile Owners Report**

**You can snap great photos
with a low-cost camera**



**THOSE
EXCITING NEW
VANS: Convert 'em
yourself for low-
cost luxury**

**F-16: The fighter
everybody wants**

**MAKE a tabletop hockey
game with float-on-
air puck...**

**PLUS 6 delightful toys
to give for Christmas**

**FUEL INJECTION:
How it works and how
to keep it in top shape**

In between too



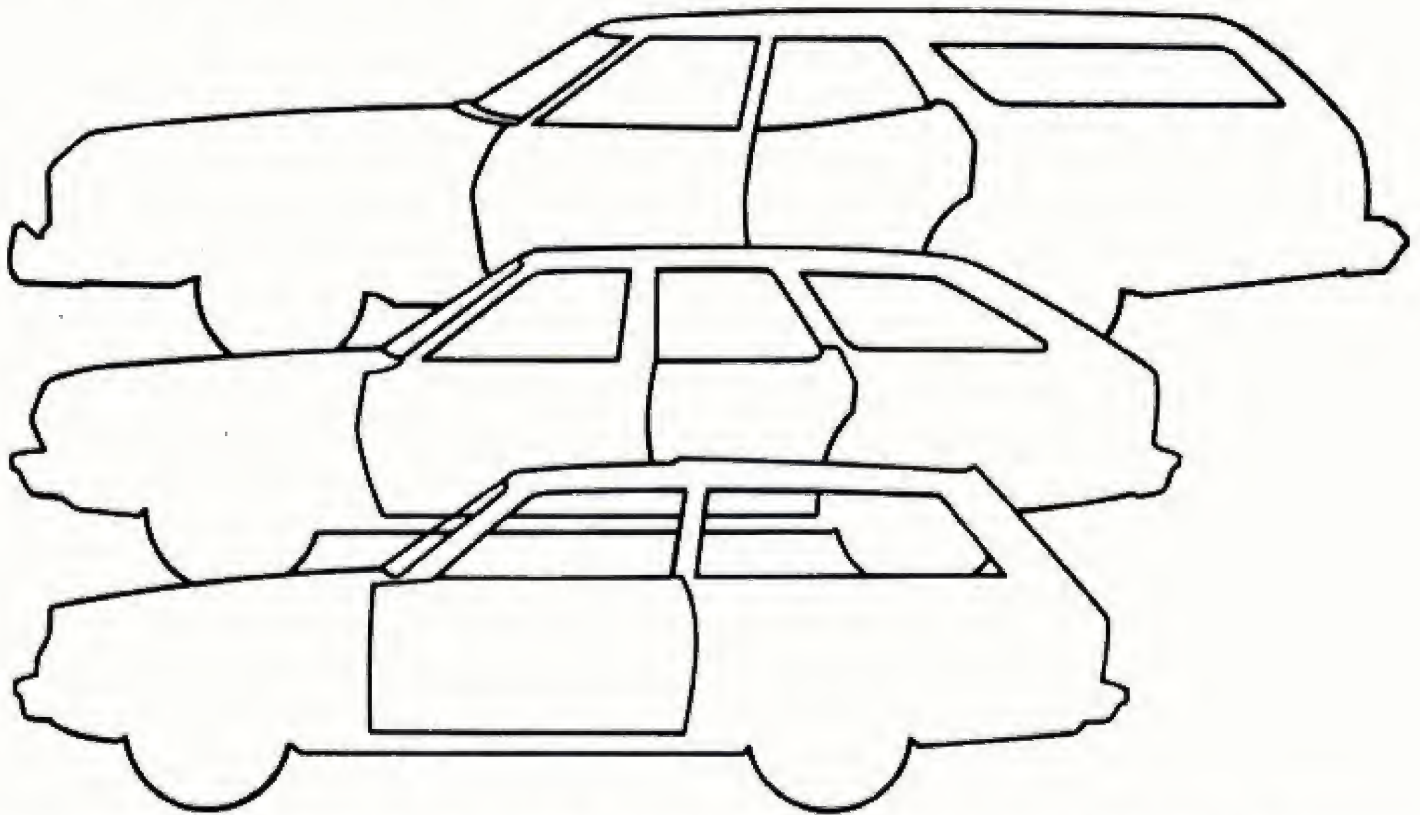
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Shock absorbers	Yes	No	No	Yes
Brake linings	Yes	No	No	Yes
Clutch linings	Yes	No	No	Yes
Wiper blades	Yes	No	No	No
All light bulbs	Yes	No	No	No
Hoses & Belts	Yes	Yes	No	No

Services provided free.

	AMC	GM	FORD	CHRYSLER
Wheel alignment	Yes	No	No	No
Wheel balancing	Yes	No	No	No
Align headlights	Yes	No	No	No
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Adjust distributor	Yes	No	No	No
Adjust brakes	Yes	No	No	No
Adjust clutch	Yes	No	No	No
Adjust transmission bands	Yes	No	No	No
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Tighten nuts & bolts	Yes	No	No	No
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*BUYER PROTECTION PLAN is reg. U.S. Pat. and Trm Off.

*Chrysler coverage is 12 months, unlimited mileage.
General Motors has 5 year/60,000 mile coverage
on certain 140 cu. in. engines.

AMC Hornet Sportabout

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ON THE COVER

One of several camping conversions of the new Econoline van created by the Ford Design Center. Others are on page 71.

AS A SERVICE TO READERS, *Popular Mechanics* publishes newsworthy products, techniques and scientific and technological developments. Due to possible variance in the quality and condition of materials and workmanship, *Popular Mechanics* cannot assume responsibility for proper application of techniques or proper and safe functioning of manufactured products or reader-built projects resulting from plans published in this magazine.

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SPECIAL FEATURES:

Refinishing furniture is easier than ever—a two-part special. Part one covers stripping of old finishes, preparing surfaces, staining. Page 114.

10 tips to keep you on the road this winter. Study and practice them now and you'll know just what to do when the need for them arises. Page 74.

Get ready for holiday hospitality with quick home fixups for chairs, doors, faucets, toilets, bathtubs, scratches, walls, ceilings, floors. Page 108.

Make a tabletop hockey game you play with a lightning-fast, float-on-air puck. Page 94. Plus six delightful toys to give for Christmas. Page 118.

F-16: the fighter everybody wants. A new concept of high-performance, low-cost supersonic jets that combine air superiority with economy. Page 72.

Does the Rabbit share all of the virtues that made Volkswagen so popular during the Beetle's heyday? See PM's exclusive Owners Report. Page 86.



Refinishing furniture 114



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Fuel injector 97



Christmas toys 118

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ADVERTISING OFFICES: New York: 224 W. 57th St., (212) 262-4282; Chicago: 520 N. Michigan Ave., (312) 527-2400; Detroit: General Motors Bldg., (313) Trinity 5-8711; Cleveland: 20310 Chagrin Blvd., Shaker Heights, Ohio, (216) 283-7786; Los Angeles: 601 N. Vermont Ave., (213) 666-6263.

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Advertising Production Manager

Published by The Hearst Corporation

JOHN R. MILLER

President

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Publisher

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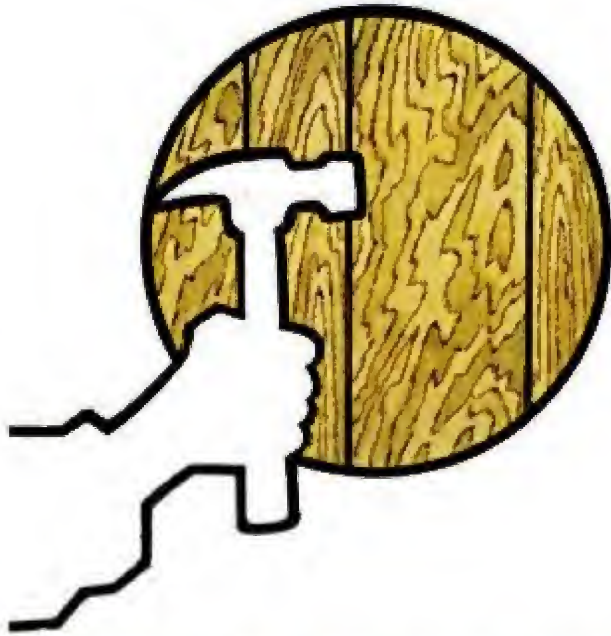
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For me, Winston is for real.

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at the big change paneling makes.

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HINTS

FROM READERS

Screwdriver twirling



Twirling a screwdriver shank between thumb and forefinger is a quick way to move a free-running screw. It's more positive with the 2 in. of shank nearest the handle covered with fine-grit abrasive cloth rough side out, attached with contact cement.—*Walter E. Burton, Akron, Ohio*

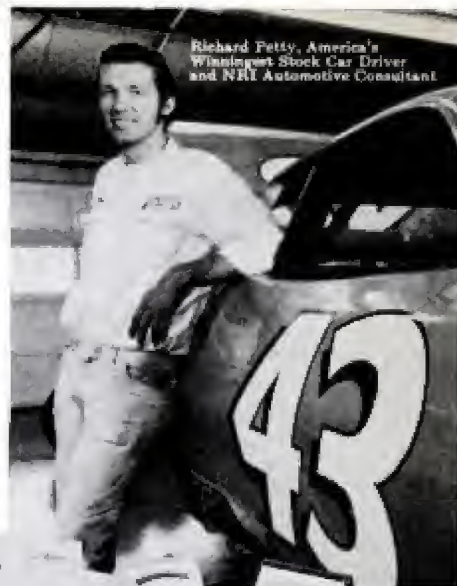
Cutting foam plastic



Thick slabs of non-rigid plastic foam for upholstery padding are extremely difficult to cut with any degree of accuracy with scissors or knife. You'll find that cutting them with your handsaw is surprisingly easy and produces very neat results.—*Rosario Capotoso, Greenlawn, N.Y.*

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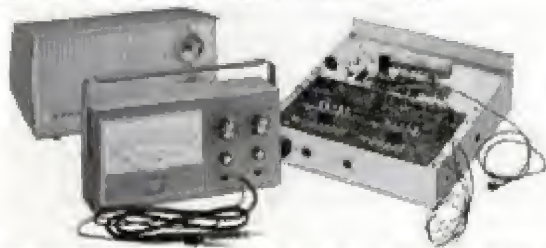
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LETTERS

TO THE EDITOR

It's no tall story

In your article about *The Guinness Book of World Records* (page 58, Sept. '75) you say the tallest structure in the world is the 2119-foot Warszawa radio mast in Poland. But I've read that the new CN Tower in Toronto is the tallest—and its height is given as 1815 feet. How can this be? Who's right?

RON WEAVER
DALLAS, TEX.

Everybody's right—it's a question of terminology. The CN Tower is the world's tallest self-supported, free-standing structure. The Warszawa mast still exceeds it by 304 feet but requires external cables for partial support. Also, at the time the article was written, the CN Tower was not yet completed, so that's why it was not mentioned.

Computerized nurse?

Wow! What will they think of next? I want to ask the super-brainy engineers who devised *The Computer You Put in Your Mouth* (page 25, Sept. '75) how they'll program the "nurse" (she looks so human) to react when I attempt to pinch her?

JAMES J. HUSA
SPARTA, MICH.

Don't worry about it. Once your letter is printed, you'll be assigned the only male nurse in the hospital.

No air force in the Bahamas

In *Go-Anywhere Fliers of the Ferry Service* (page 68, Sept. '75) James Liston quotes a ferry pilot to the effect that his aircraft and two others were forced down in the Bahamas by a P-51 for overflying the islands. An accompanying caption refers to "Bahamian military P-51s."

I thought that tall-tale pilots went out with jet propulsion.

The facts are that the Bahamian government neither owns nor operates Mustangs or military aircraft of any type. You should hold another debriefing session with the pilot and request facts instead of fiction.

WILLIAM H. KALIS
BAHAMAS NEWS BUREAU
NASSAU, BAHAMAS

The incident is fact, but it actually occurred at Santiago, in the Domini-

can Republic, where the pilots were forced down by P-51s and detained for about 45 minutes. The confrontation resulted because the Bahamian government failed to forward the flight plan which the pilots had filed before leaving the Bahamas. "The error in the manuscript occurred," Liston says, "when I was transcribing tapes. This is how an oversight becomes an overflight."

Hide and tell

In reference to your article, *10 Good Places to Hide Your Valuables*, (page 74, Sept. '75): People who hide valuables in such places should tell their close relatives or friends in case of death.

When my mother died, we had to practically tear the house apart to find the things she had hidden. Fortunately, my aunt remembered my mother had put a diamond ring in a light fixture, or the house would have been sold with the ring still there.

WANDA LONGNECKER
ALAMO, CALIF.

I was very interested in the article, but I just wanted to tell you to forget the one about the false bottom for a drawer. San Antonio burglars are taking drawers and all. It happened to a friend of mine. She had to have a cabinetmaker build new ones.

MRS. O. SCHULTE
SAN ANTONIO, TEX.

'Young punks' and U.S. cars

Replying to G.L. Bradbury (*Letters*, page 5, Sept. '75) as to why "inexperienced young punks" don't buy American cars and keep American workers working: At age 64, I see no virtue in keeping arrogant, brutal, stupid bandits at work. For decades they have used the strike to price themselves out of work, and they are getting exactly what they've struck for, at the cost of the rest of us.

American-made cars were good, but now they stink, at outrageous prices. Don't blame the customers—they've had it.

THOMAS SPENCER
PLANTATION, FLA.

Mr. Bradbury is an exceptionally fortunate person. He must have received all the good automobiles and I, all the lemons.

It is difficult to believe any one car to be so satisfying as complaint-free, let alone seven.

In my 48 years and 13 automobiles, I have been greatly disappointed with the inferior quality and poorly assembled cars that I have owned.

JOE LORUSSO
CHICAGO, ILL.

I am one of the "inexperienced young punks" who owns a BMW and I am bragging because I own and drive an excellent automobile. I drive a foreign car because U.S. auto companies don't come close to building what I want in an automobile, and BMW does. My 1968 1600/2 has better than 180,000 miles on it, hard miles in which it has run logging roads on hunting and fishing trips; in which it has towed a loaded VW while averaging the speed limit for 600 miles (and giving me better than 20 mpg at the same time); in which it has made a good account for itself in Sunday afternoon autocrosses; in which it has been well-behaved during 18 months of traffic jams in the nation's capital; and for all of which I love it.

Yes, it has faults: window wind mechanisms break regularly, and water pumps last about 40,000 miles. Yes, I sometimes have to wait a few days on parts, but nothing to compare with the four months it took to get a replacement exhaust manifold for my wife's 1971 Plymouth six-cylinder.

My only regret since buying the BMW is that I didn't buy 10 more at the same time, to be used for the rest of my life. Yes, BMWs are expensive, but if a Vega is worth \$4000, then a 2002 is worth \$6000 today. If a Cadillac is worth \$10,000, then a 3.0CS is worth \$14,000.

THOMAS H. WALKER JR.
DAUPHIN ISLAND, ALA.

'A dumb idea'

I think the person who wrote the article *How to Buy a New Car at Old Prices* (page 60, Aug. '75) is nuts. A person who always had power steering, power brakes, automatic transmission should not be without them. I, myself, would not be without airconditioning. I suppose I could put

(Please turn to page 164)

POLICE CALLS, FIRE CALLS, MARINE CALLS... AND BEETHOVEN, TOO!



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IMPORTS AND MOTORSPORTS



Jump-seat Jaguar

It's James Bond's kind of car. It's sure to show up on television in a shoot-'em-up series—the perfect car for whisking good-guy spies out of danger in the nick of time. The S-type Jaguar is the first all-new Jag since 1968 (when the XJ6 was introduced). A 2+2 grand touring car, it replaces the E-type (now out of production). When it becomes available here this month, the XJ-S will

ones selling despite the slump. If film producers are watching budgets these days, they'll appreciate the fact that at \$19,000, the XJ-S costs \$14,000 less than the current Aston Martin—the original James Bondmobile.

Scooter roter

I always liked those motor scooters I first saw in foreign movies: funny, fat things, mostly Vespas, that picked out the holes in traffic and sneaked through, their riders oblivious to the cacophony of car horns. The streets of Rome were alive with them: Gas prices, you know.

Now there's a new shape to the motor scooter. The 72-cc "Chappy" is a step-through and streamlined scooter from Yamaha. The 165-pound machine, rated at 118 mpg, has an automatic transmission to make riding easy. Yamaha sees it as a short-distance commuter scooter. But as the gas price continues to go up, I see the length of those trips going up, too. Yamaha International Corp., Buena Park, Calif. 90620.



"Slow" Porsche

What does this silver bullet of a car share with VW's famous box of a bus? Would you believe the engine? In the new 912E the two-liter flat Four will transport you at a secure 110 mph; in the bus you might squeak out 80—if you were that brave. The 86-hp 912E is new to the Porsche lineup for '76 and it marks the return of a four-cylinder engine option for the sleek 911 body. The price of the 912E will be just under \$11,000, or about \$3000 less than the six-cyl-



inder, 157-hp 911S. Performance, too, is less than what you get with the "real" Porsche. I drove the poor man's version and found the handling every bit a Porsche (indeed, the car is identical except for the engine), but the performance will excite only those who've never had the pleasure of driving a version of the 911: Top speed is a solid 110 mph, but 0 to 60 times are in the 13-second range.

The 914 is unchanged for 1976, and that leaves just one more Porsche model, new for '76, that we haven't mentioned. We'll have all the info next month. By the way, see our story on turbocharging in December. ★ ★ ★

Jaguar XJ-S 2+2 GT Specifications

Engine
12-cylinder aluminum alloy 90° vee, with overhead camshafts, 7-bearing crankshaft.
Compression ratio: 8.0:1.
Bore: 90 mm (3.54 in.)
Stroke: 70 mm (2.76 in.)
Displacement: 5343 cc (326 cu. in.)
Bosch-Lucas electronic manifold fuel injection.
Fuel tank capacity: 23 gal.

Transmission (Borg-Warner)
3-speed auto, torque converter. Rear axle ratio: 3.31:1. Limited-slip differential.

Steering
Rack and pinion, power assisted. Turns, lock to lock: 3.25. Turning circle: 39 ft.

Suspension
Front: Fully independent semi-trailing wishbones, coil springs. Antidive geometry. Antiroll bar. Rear: Lower transverse wishbones. Drive shafts acting as upper links. Radius arms. Twin coil springs and damper units. Antiroll bar.

Brakes
Power-assisted 4-wheel discs.

Road wheels
Cast aluminum alloy, ventilated wheels, 15-in. diameter, fitted with Dunlop SP Super 205/70 VR15 steel-braced radial-ply tubeless tires.

Ignition
Lucas Opus MkII electronic.

Dimensions
Wheelbase: 102.00 in.
Overall length: 192.25 in.
Overall width: 70.62 in.
Overall height: 47.80 in.
Track f/r: 58.62 in./58.65 in.
Curb weight: 3935 lb.

sport a sticker that bottom-lines at \$19,000. That's between the Porsche 911S and the Mercedes Benz 450SLC and other really expensive cars—the

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PHOTO HINTS

FROM READERS

How to cut enlarging paper neatly—even in the dark



Trimming paper evenly can be hard enough in full room light—trimming enlarging paper under a dim safe-light would be even harder if it weren't for this paper guide. It's just a strip of hardwood with two protruding dowels which fit into corresponding holes drilled in the paper-cutter surface. The guide strip should be about $\frac{1}{4}$ -in. high by $\frac{3}{4}$ -in. wide and about 9 in. long.

Drill $\frac{1}{4}$ -in. holes about $1\frac{1}{2}$ in. from each end, then use these holes as a template to locate and drill the holes in the top of the cutter. You can drill a set of holes for each of the widths you frequently will cut to; measure in from the cutting edge to the closest side of the strip, making sure the strip is exactly parallel to the cutting edge. Drill the holes about $\frac{3}{4}$ -in. deep. Glue $\frac{5}{8}$ -in. lengths of $\frac{1}{4}$ -in. dowel into each hole in the strip, rounding the protruding dowel ends. Enlarge the holes in the paper cutter top with a $9/32$ -in. drill, to allow the dowels to slip in and out without binding yet still fit snugly.

—Walter Gustafson, St. Paul, Minn.

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For sheer ease of operation, no photo enlarger surpasses Omega's Pro-Lab B66 for 35mm and $2\frac{1}{4}$ " negatives.

The spring-loaded negative carrier opens wide when you lift the lamphouse, letting you advance negatives without disturbing their alignment. The lamphouse assembly is counterbalanced for smooth, easy movement. And a sliding panel allows instant access to the lamp, condensers and filter drawer.

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BY EUGENE A. SLOANE



THE BICYCLE SHOP

GENE ANSWERS READERS THIS MONTH

Superlights

Some time ago you wrote about Corsa Strada superlight wired-on tires. Where can I buy them? Are they tough enough to stand rough roads?
—Wayne Hill, Lansdowne, Pa.

Buy them from any Raleigh dealer. Yes, they're tough. Two years ago, I rode on them all over the back roads of France. These tires fit onto 27-in. wired-on rims, are lighter and, at 1 1/8 in. wide, are narrower than conventional 1 1/4-in. wired-on tires, and so offer less rolling resistance.

Self-tightening freewheel

My Shimano freewheel tightens when I pedal and won't move. I have to loosen the bearing retainer ring on the freewheel, but it tightens up again.—Steve Hill, Offutt AFB, Neb.

The freewheel could be rubbing on the hub, the pieplate spoke protector or the axle locknut. Remove the wheel. Spin the freewheel to see where it's binding. While the freewheel is off, remove and discard the pieplate—it's just extra weight. If you took the freewheel apart, did you replace all the bearings?

Butts and lugs

Which is better, a single or a double-butted steel frame? What is the difference between a butted frame and a lugged frame?—S. Oliver, Medford, N.J.

A double-butted steel frame such as the Reynolds 531 is thicker at the ends of the tube than in the middle, for greater strength. However, a high-quality single-butted frame of Reynolds 531 alloy steel, or Columbus or Super-Vitus alloy steel, is strong enough for the average touring cyclist. The drawing below shows what a 24-in. double-butted top tube looks like inside—with diameter exaggerated. Single-gauge tubing lacks variation in inside diameter.

A lugged frame is one that has

steel lugs into which frame-tube ends fit. But a good, hand-made brazed lugless frame is very strong, so lugs alone don't always indicate quality construction.

Rough rider

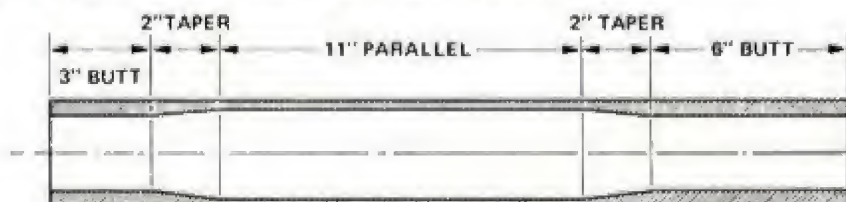
I need a bike to ride to school nine miles away. I would like to spend not over \$100. Any suggestions?—Randall Angst, Amherst, Mass.

Sorry, there's nothing I can recommend for less than \$130—that's for a Schwinn Varsity 10-speed. Check newspaper want ads. Lots of people are upgrading their cycling and selling their old 10-speeds. Just be sure the bike fits you. See below.

Unscrambling sizes

Please straighten me out on bicycle frame size. I see newspaper ads for 27-in. and 22-in. bicycles, yet both appear to be the same size.—Tom Marcus, Shreveport, La.

People who write newspaper ads often know very little about bicycles, and confuse wheel diameter with frame size. A 27-in. frame would be about right if you were 6 1/2 ft. tall. You measure frame size by the distance from the top of the seat tube (where the seat post enters) to the centerline of the bottom-bracket axle (crank axle). Going by measurement is difficult, because people of the same height have different leg lengths. The most practical way to fit a bike to you is to remove your shoes, stand straight up over the top tube (do not sit on saddle) and make sure there is about 1 in. of clearance between you and the tube. If much less, you could get hurt in an emergency stop as you come down off the saddle. With little or no clearance, you will have trouble getting on and off the bike, and it will be awkward for you. With too much clearance, it will be difficult or impossible to pedal efficiently. ★★★



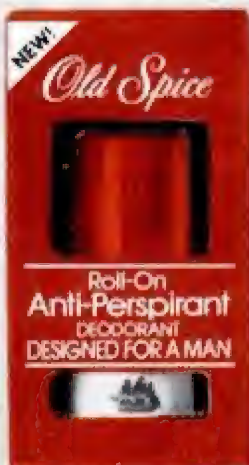
24-INCH DOUBLE-BUTTED TOP TUBE



New Old Spice Roll-On Anti-Perspirant gives you a big ball applicator in a hefty container that lets you know it's made for a man. And the formula...that's masculine too.

Real man—sized protection against both wetness and odor.

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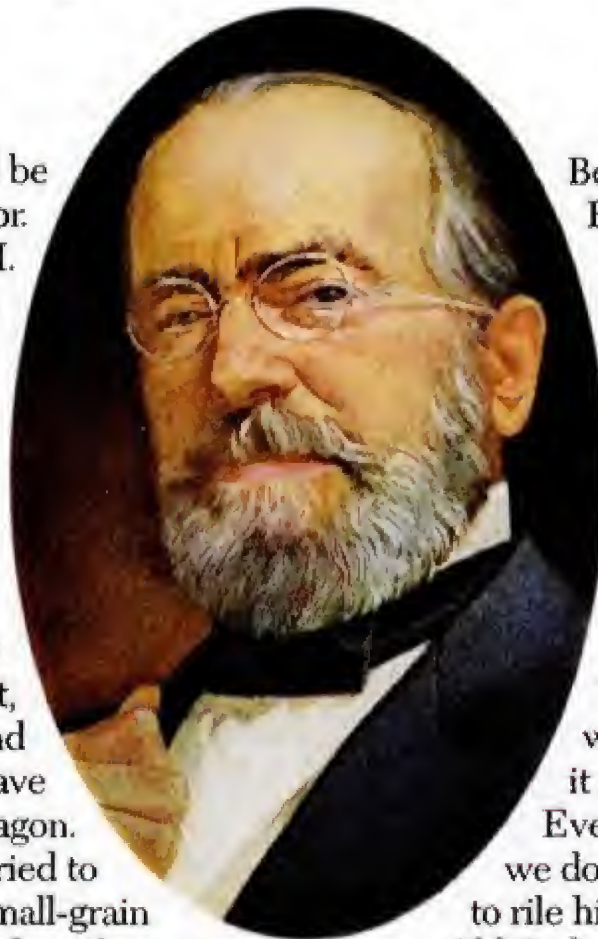


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Taylor Jr. swore that his
Bourbon would be the
best in Kentucky.
And if a bungler or a
sloven stood in his way,
the Colonel would as
soon nail him to the wall.
If a cooper delivered
some white-oak barrels
that were a knot off perfect,
the Colonel was the kind
that'd grab an axe and stave
in every barrel in the wagon.
And if a hapless farmer tried to
sneak less than choice small-grain
corn past the Colonel, his fury, they say,
could make every window sash in old



Bourbon County rattle.
He could be a rough,
tough, mean son-of-a
something, our Colonel.
But, oh, the Bourbon
whiskey he made.
Gentle on your tongue,
soft in your gullet and
as smooth as limestone
rocks worn slick by
spring water.

We still make Old
Taylor the slow, quality
way the Colonel wanted
it made.

Even now,
we don't want
to rile him.
Old Taylor. *His*
Bourbon. Try it.



It took years to
find water clear and
crisp enough for the
Colonel's Bourbon.

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For one flawed barrel,
Colonel Taylor might take
an axe to the whole wagonload.



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APPLIANCE CLINIC

BY PAUL MANN



Lightless oven

The oven of my Magic Chef gas range fails to light though the pilot is working. Can you tell what's wrong?—Ralph C. Wiser, Orange, Calif.

In all likelihood, the safety-control valve has failed. Its capillary can become porous and permit a loss of mercury; this loss will keep the gas valve from opening. If no gas gets to the burner, the oven won't work even though the pilot may glow.

If you want to tackle the repair yourself, first you *must* turn off the main gas valve to the range. Now, at the pilot you will find two tubes. One, probably aluminum, feeds the pilot. The other, $\frac{1}{8}$ to $\frac{3}{16}$ in. in diameter, is the capillary tube. Trace this. It stops at the safety-control valve. Remove tubing from the valve and unbolt the part. Its part number will probably be stamped on the bottom; get the same numbered part or a listed equivalent. If you're dubious about doing this job, call your local gas company. A serviceman will be sent, and the charge will be nominal.

Diffuser needed

I've had to replace the thermocouple generator in my J071 Caloric range twice in the three years we've owned it. Any idea why it's failing?—Werner Leiser, Suffern, N.Y.

Caloric recently modified this thermocouple by adding a diffuser that slips over the front of the generator. The purpose of the diffuser is to prevent the thermocouple from being hit directly by the pilot flame; the diffuser spreads the flame. It's possible that the thermocouples you've gotten haven't had the diffuser. Direct flame can cause failure, so when you order a new thermocouple (part No. 90165A), make sure it's equipped with the diffuser.

Probably the pump

Our Whirlpool washer, about 15 years old, fills and washes okay, but when it comes to rinse and spin, the water doesn't drain and the tub spins very slowly. If I remove the drain hose from the standpipe and drop it down almost to floor level, water pours from the hose and the tub begins spinning faster and faster as it goes empty. What's wrong?—Ted Breckman, Ft. Lauderdale, Fla.

How does a bad pump strike you? If you are very lucky, the trouble might be a clogged drain hose, but I doubt it. To be sure, though, hold the end of the hose to your mouth and blow into it. If air passes freely, replace the pump. This isn't such a big job to do yourself, and you'll save about \$30.

In your particular unit, you reach the pump by tipping the machine back on its rear legs to go in from below. Be sure that the water valves are turned off and pull the power cord from the wall socket, of course. Position a pail beneath the pump, because you'll probably get an out-rush of water when you drop it. Detach the old pump and put in a new one, making sure that all connections are tight.

Grease ripoff?

I recently replaced some worn parts in my Maytag washing machine. I got the parts from an authorized dealer along with a can of lubricant, and that is what's bugging me. The lubricant—a so-called "special"—cost me \$4.10 for a pound container. Is this high-priced lube really so special, or is this another one of those deals where the public is being ripped off by a company that's having a grease canned for them with their own name on it? Will any other grease do just as well?—E. Hessel Jr., Edwardsville, Ill.

Ripoff? In this age of investigation and consumerism, a cheap stunt like the one you suspect would be a foolish thing for a major company to try. The lube you refer to is made for Maytag, that's true. Maytag isn't in the grease business. But it is made to Maytag specifications for use in Maytag washers. If you were to use just any grease, it could break down and ruin all your work.

Backward temperatures

I have a two-door Westinghouse refrigerator that won't go below 22°F. in the freezer section and goes down to 30°F. in the refrigerator section at the coldest settings. A repairman replaced a temperature regulator, but to no avail. Doors are tightly sealed and the compressor area is clean. What now?—George Vouvalides, New Milford, N.J.

If the refrigerator is less than five years old, contact Westinghouse. I'll bet the problem is being caused by a low charge of refrigerant owing to a slow leak in the evaporator, condenser or one of the connections. These parts are warranted for five years by the manufacturer. Obviously, the freezer is too warm (should be 0°F.) and the refrigerator too cold (should be 38-42°F.). The reason for the reversal is that the freezer compartment isn't getting cold enough to satisfy the control, which is not shutting off. This sends refrigerant circulating through the refrigerator section, dropping its temperature below normal. If the unit is older than the warranty period, you'll need to call in a serviceman—recharging the system is not a do-it-yourself job.

Getting a kick

When I pull the starter cord of my Briggs & Stratton lawnmower, there is a terrific kickback which breaks the cord. I've tried a longer cord without success. What's causing this, and what can I do about it?—M.A. Cass, Enfield, Conn.

Kickback severe enough to break starter cords, in 99 percent of the cases, is caused by a loose blade. You can try simply tightening the blade and testing to see what happens, but the wiser repair method is to remove the blade and examine the blade adapter on the shaft and the blade bushing for wear. The bushing rides on the adapter. If either is worn (grooved), replace it. In most instances, the blade adapter is the part that wears. Remove the adapter by removing the key from the keyway. After replacing the adapter, reinstall the blade assembly and make sure the blade is attached tightly.

If you're in the 1 percent whose kickbacks are not caused by a loose blade, have the machine's ignition system timed to specification. Mistiming is a much less likely cause of kickback, but it happens. ★ ★ ★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York N. Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.



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Chain Brake in
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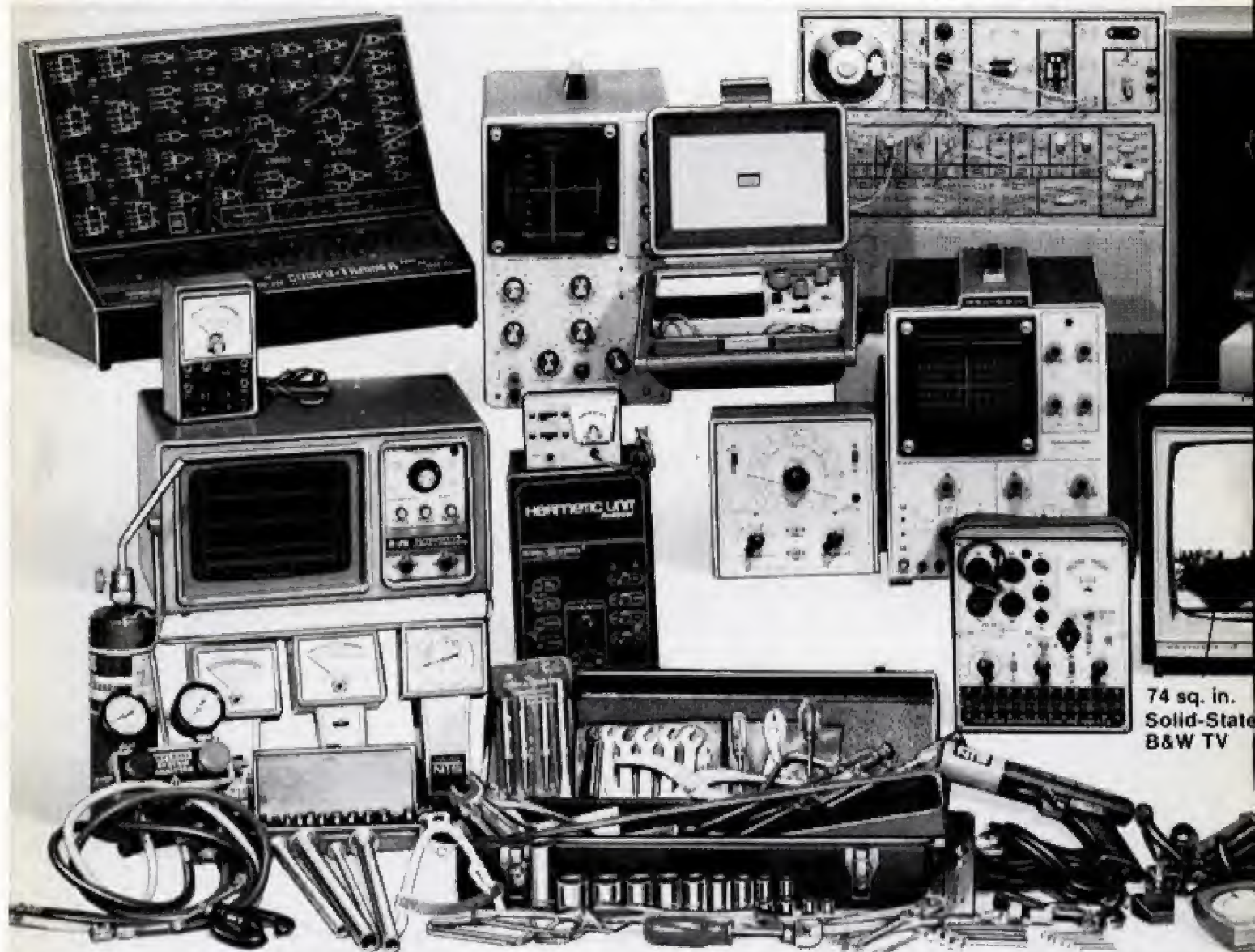
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The Standard of Excellence
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How to set up an auto-repair cooperative

You and your neighbors and friends
can save a bundle by pooling your
talents and tools.

by Mort Schultz

Five men in search of thrift have found one another and success. Calling themselves the Massapequa (Long Island, N.Y.) Mini Cooperative, they save themselves hundreds of dollars in auto repair costs.

None is a professional mechanic. In fact, several are quick to admit that when the group formed they knew little about cars.

But working collectively, pooling tools and chipping in to purchase test instruments in the group's name, the five regularly tackle their own oil changes, lubrications, engine tune-ups, cooling system service, brake work and more.

"Hell, we'll try anything we can get our hands on," Sheldon Rosenberg states.

Rosenberg's cars epitomize the accomplishments the group has achieved. He owns a 1964 Plymouth that has gone 122,000 miles and a 1970 Chevelle with 70,000 miles.

Major repairs not needed

"Neither car has ever had to have a major, expensive repair," Rosenberg says. He attributes this to his program of periodic maintenance.

His success is not a fluke. Each member of the mini co-op owns relatively older-model cars having relatively high mileage, which I suggest puts to rest the "theory" that cars are built to obsolete themselves at 50,000 miles.

Jerry Brown drives a 1969 Plymouth which has been driven 76,000 miles and a 1965 Renault having 45,000 miles.

Bill Cooney's 1963 Chevrolet shows 80,000 miles on the odometer. He doesn't talk about his 1974 Volkswagen with 13,000 miles. "Too new," he says.

Ralph Dankner, who's a salesman, really puts the mileage on. Both his 1971 Ventura and 1971 Ford are

(Please turn to page 30D)



Parking-brake rod of his 1965 Renault is adjusted by co-op member Eli Goldberg.



Battery charging is done by Ralph Dankner. Trickle charging extends battery life.



Timing of his Plymouth's engine is done by Jerry Brown. Tools are jointly owned.



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12 pc. $\frac{3}{8}$ " drive Socket Set for auto maintenance, lawn and garden equipment. 4 each 6 and 12 pt. sockets, spark plug socket, 2 extensions, reversible S-K ratchet. Metal box.

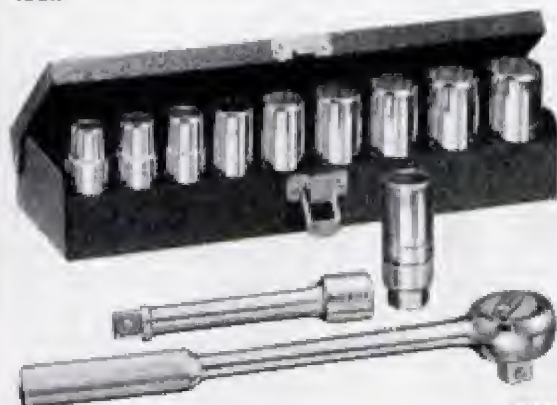
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9 pc. alloy Combination Wrench set for 1001 uses at work or at home. Comes in a vinyl pouch. 9 rugged combination wrenches, nickel chrome plated and highly polished. Sizes $\frac{1}{4}$ " to $\frac{3}{4}$ ".

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AUTO-REPAIR COOPERATIVE (Continued from page 30B)

nearing 70,000. Also near or above the 70,000 mile mark are Eli Goldberg's 1969 Plymouth and 1969 Dodge.

None of the group has any intention of trading their present cars for new ones.

Too many miles left for trades

"There are too many good miles left in them," Brown states.

It was Brown who sought out the others and started the group. The five reside only minutes away.

"Initially, we were motivated by the inability to find professional mechanics who could do satisfactory work," Brown says. "We were disgusted with sloppy workmanship and outright cheating."

The group pooled little more than \$100 and purchased a timing light, dwell, tachometer, a set of ramps and a battery charger. Each member gathered his own set of hand tools, including open and box-end wrenches, plus sockets and drives.

Some own tools that the others don't. Goldberg, for example, has become proficient at doing brake jobs and owns all tools for doing this work except a drum-turning lathe. He farms drums out for \$2.50 each.

"The last brake job I did on my Plymouth, which was about 10 months ago, cost me \$23 for parts and having drums turned," Goldberg says. "I bet you can't get the same caliber of work done around here for less than \$75."

Share tools and know-how

If one member owns a tool that another needs, he feels free to borrow it. There is also an eager willingness to share knowledge.

For example, both Brown and Cooney have technical backgrounds and are often asked for advice. Brown has had formal training in internal combustion engine theory and served as an aircraft mechanic with the Air Corps during World War II. His occupation, however, is president of a firm that manages and conducts industrial trade shows.

Of the members, only Cooney is engaged in a technical occupation. He is an aircraft mechanic for an airline at Kennedy Airport.

Goldberg is a baker. Rosenberg is a merchandising manager for a textile firm, and as mentioned Dankner is a salesman. The occupations of the group sort of shoot down another "theory"—that you have to "know cars" to work on them.

"Even if none of us had any knowledge about a car, we would still



Changing engine oil (at top) is Sheldon Rosenberg. Eli Goldberg (above) adjusts point dwell on his Chevelle.

do what we are doing since we can read," Brown claims. "There is ample information about cars in our public library."

Library loans tools like books

As a trustee of the Plainedge Public Library in Massapequa, Brown was instrumental in helping start another unique program . . . one which no other public library in the country, as far as I know, offers.

"Although the library had all this information about car repair, the individual who lacked instruments couldn't do a tune-up," says Brown.

He proposed and the library board agreed to purchase three timing lights and three dwell/tachometers. Instruments are loaned like books.

How much money have members of the Massapequa Mini Co-op been able to save? It is difficult to pin this down exactly, because there are several intangibles. How can you place a price tag, for example, on the longevity they add to their cars by being able to do more frequent servicing, because they do things themselves?

Save nearly \$150 a year

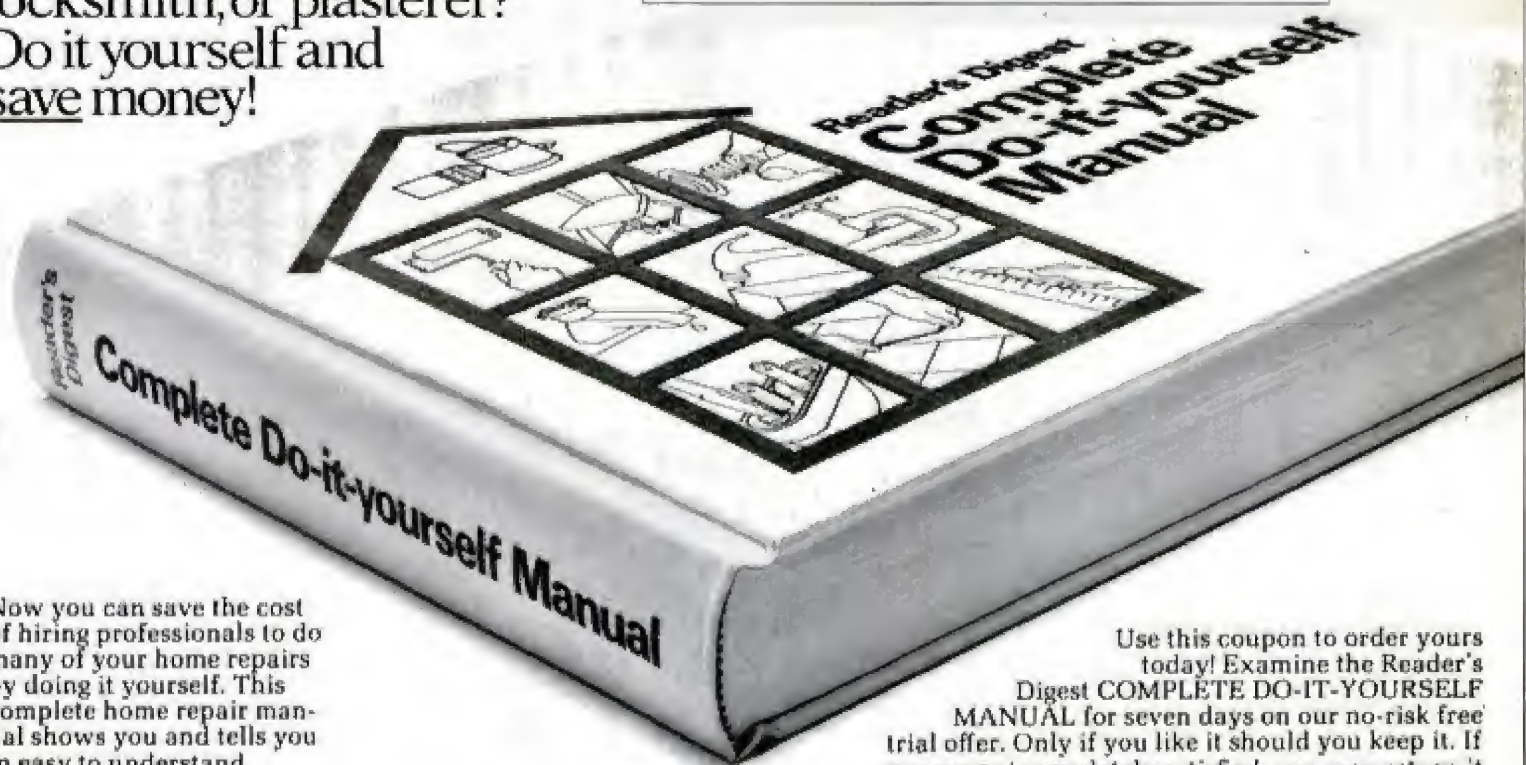
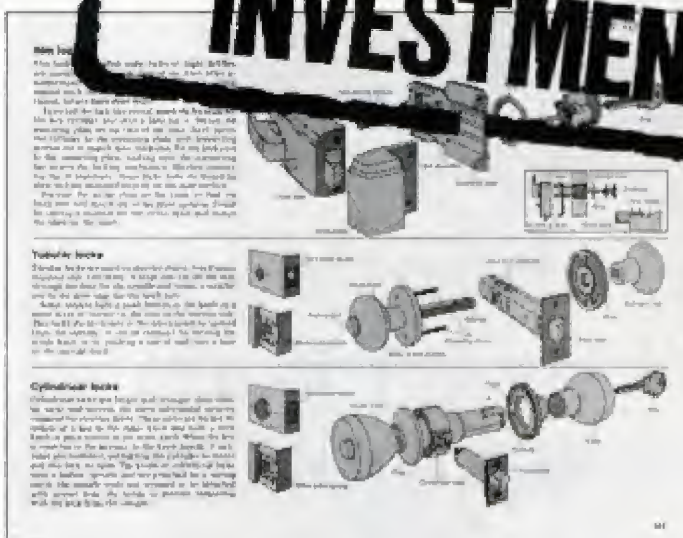
But the saving realized by not having to hire mechanics to change oil, lubricate the chassis and do tune-ups amounts to almost \$150 a year per member for one car. Naturally, the saving is double for members

(Please turn to page 30F)

The pay-for-itself book... try it free!

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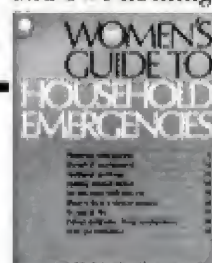
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Best of all, you get them where you'll be getting your parts and plugs and tune-up kits anyhow. At a professional auto parts or speed shop.

Since you're going to be a good customer, the guys at the shop will be glad to help you out with any friendly advice you need, about using the tools or buying the parts. (If you're not too sure how a dwell tach works, you better get one from someone who is.)

Before long, you'll be one of the guys, too, and the expert on your block.

If you're serious about working on your car, get the best there is. At the best place to get it.

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AUTO-REPAIR COOPERATIVE

(Continued from page 30D)

who own two cars. Here's the way it figures:

Oil is bought by the case on sale from discount and department stores. Instead of costing \$1 a quart for SAE 10W-40 oil, it costs about 60 cents a quart. This is a 40 cents-per-quart saving, or \$2 every time a member of the group changes oil, assuming a normal five-quart capacity per car.

More oil changes

Co-op members believe in changing their crankcase oil at least once every two months. They affirm that the longevity of their vehicles is directly related to these frequent oil changes.

Thus, they realize a saving of \$12 a year just in the price of oil.

They also save on the labor charge a mechanic would get for draining the crankcase and lubricating the car. This amounts to about \$5 every time, or \$30 a year assuming that an oil change and a lube job are done every two months.

Totally, then, each member of the co-op saves \$42 a year in simple lubrication costs—in doing a job for which you need neither special tools nor experience. Added is the saving in buying oil filters on sale, raising the total to about \$50 a year.

How much does your mechanic charge for tuning up a car's engine? In the New York Metropolitan area, the cost is about \$50.

Members of the co-op save this amount twice a year (that's how often they do tune-ups), except when they have to replace sparkplugs, points, condenser and other parts. Which isn't often.

"By prolonging extensively the useful life of sparkplugs, distributor points, condensers, rotors and other parts normally replaced prematurely by auto repair shops, we stretch our dollars farther," Brown contends.

"For example, manufacturers generally recommend changing sparkplugs at 10,000 miles. U.S. government agencies ignore this recommendation and discard plugs at 15,000 miles. We ignore both and clean plugs periodically, replacing them when they need replacing. Thus, we get up to 100 percent more miles than manufacturers would have us get if we blindly followed their specifications," Brown says.

Dump used oil in fuel-oil tank

Co-op members have encountered few problems they haven't been able to handle. For instance, one situation that arose was what to do with

(Please turn to page 30H)

FREE FOOD

Now Americans from all walks of life—office workers, students, executives, housewives—are eligible for food stamps. In fact, the government's food-stamp program is so generous, it amounts to giving away free food.

No longer is the food-stamp program limited to the poor. In fact, under certain circumstances you can qualify for food stamps even if you earn over \$15,000 a year. As the chairman of a United States Senate committee has declared, "Increasingly, food stamps are becoming a middle-class phenomenon."

Twenty million Americans—nearly one in ten—are now benefitting from food stamps. But here's the most astonishing fact of all: **Twenty million others are eligible and DON'T KNOW IT!**

Are you one of them? Don't you owe it to yourself to find out if you're eligible?

Exactly what are food stamps and how do you qualify for them? Food stamps are a form of "currency" redeemable at most supermarkets, groceries, and (in some cases) meals-on-wheels home-delivery food services. You buy them from the government at a discount that is determined by the size of your income, household, and living expenses. In top brackets, food stamps can triple or quadruple the buying power of your food dollar—and, if you're like the average American, food is the single biggest item in your budget.

Some families are now deriving as much as \$4,000 a year in additional buying power thanks to food stamps. Shouldn't you find out if you qualify?

The facts about food stamps are not easy to get. Senator George McGovern and other experts have accused the government of deliberately trying to hide the facts in order to curtail the size of the food-stamp program. But Moneysworth, the crusading consumer-affairs and personal-finance newspaper, is pleased to announce publication of a clearing, enriching, honey of a booklet that reveals all. Its title is: **YOUR PIECE OF THE PIE: How To Cash In On Food Stamps**, and a copy is yours **ABSOLUTELY FREE** with a 2-week subscription.

How much does a subscription cost? Incredibly, **ONLY \$2.99!**

In case you're unfamiliar with Moneysworth, let us explain that it is America's most authoritative, scintillating, wallet-fattening periodical dealing with consumer affairs. It is now read by over three million passionate devotees.

Each issue brims over with such high-interest, inflation-defying, Mi-
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Cookware that Won't Go to Pot
How Doctors Diet
Is Cancer Contagious? New Findings
Legal Ways to Beat Sales Taxes
The Nickel Phone Call Rises Again

In short, Moneysworth is a live wire sparking off hot information on the current money scene. It galvanizes readers all over the country into sending ardent letters like these:

"Thanks to Moneysworth, I am \$5,417 richer. I battled the Social Security Administration unsuccessfully for 18 months, then finally won out by following the advice of your article 'By All Means, Appeal.'"
—S. Dominguez; Waterbury, Conn.

"Your article on air-fare 'triangular' routes was an astonisher. My wife and I saved \$100 each on a trip to New York by stopping off at Las Vegas as you suggested."
—H. Kesselman; Los Angeles.

"Boys, you are not going to believe this, but I have parlayed \$146 into \$90,000 thanks to your informative article on breaking into real estate."
—Horace T. Pinrose; Montgomery, Iowa.

"The government has proven itself completely impotent in the fight against inflation. My only salvation comes from advice I find in Moneysworth. It saved me as much as I lose through inflation."
—Theresa Ramseyer; San Francisco.

"Your article on the 15% interest paid by Mexican banks has made it possible for me to retire in style."
—Eric T. Svenson; Fallbrook, Calif.

"Your write-up on income averaging for tax purposes saved us \$1,100 this year. We didn't realize retirees could do this."
—Mr. & Mrs. J.W. Long; Morro Bay, Calif.

"We salute Moneysworth for its excellent report on our free sex-counseling-by-telephone service. As a result of it, we've received calls from all 50 of the United States—including Hawaii and Alaska—and even a few from Europe and Africa."
—Community Sex Information; Boston; (617) 232-2335.

"Your recommendation that readers reduce orthodontic bills by having the work done at a university dental school saved me \$1,350 on my daughter's teeth."
—Bob Walters; Oxon Hills, Md.

"Your tip on flying to Europe via Afghanistan saved me \$450. You've made me a subscriber for life."
—Charles B. Fager, M.D.;

Harrisburg, Pa.

"Your advice on Social Security resulted in a \$3,135 lump-sum cash payment to my wife, and \$171 monthly pension. The best investment I ever made was a subscription to Moneysworth."
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"As a result of your article on nonprofit, low-cost memorial associations, we have been receiving 400 inquiries per day. You'll get an inkling of the immense amount of money your subscribers have saved when you realize that each of our members saves well over \$1,000 on a funeral."
—R.J. Stevens, President, Continental Association of Funeral and Memorial Societies; Chicago.

"Your tip about deducting the cost of transportation between my two teaching jobs saved me in taxes at least the cost of a ten-year subscription. Not only that, but your publication is lively, off-beat, a delight to read."
—Professor Reuben Garner; State University College; Brockport, N.Y.

"Thanks to your article 'How to Buy a New Car for \$125 Over Dealer's Cost,' I just bought a Chevy at a saving that I estimate at \$350."
—Ron Bromert; Anita, Iowa.

"Your article 'Inaccurate Billing by the Phone Company' led me to discover four years of overcharges. I got a \$1,593 refund."
—Armand DiRienzo; Bristol, Pa.

"Moneysworth's product ratings sure stretch the dollar. I bought the Canonet 35MM rangefinder camera you recommended, and saved 30%."
—R. Goodrich; Tucson, Ariz.

"Your article 'How to Fight a Traffic Ticket' saved me a \$200 lawyer's fee and a ticket."
—W.R. Wendel; Hicksville, N.Y.

"Your article on how to save \$100 on a color TV worked. Moneysworth sure knows how to hold onto the green."
—P. Allen; Dir. Student Union; Henderson College; Arkadelphia, Ark.

"Your article on 'coupon refunding' got my husband and me hooked on the hobby. It saves us enough each year to pay for our vacation."
—Grace Ellen Feingold;

Brooklyn, N.Y.

"You sure did us a good turn recommending Mayflower for our move from California to Minnesota. Would you believe the bill was a hundred bucks under the estimate?"
—D.J. Ganzer; Owatonna, Minn.

"Upon Moneysworth's advice, I asked the phone company for an itemized bill. As a result, I discovered that for years I had been paying for a nonexistent extra line. Result: A \$550 refund. My trial subscription has paid for itself 110 times over!"
—George Petsche; Washington, D.C.

"Your report that dentures cost only \$40 at the Sexton-Shealy Dental Clinic of Florence, South Carolina, saved me hundreds of dollars. They fitted me up in 24 hours and I completed the entire procedure during a vacation to Florida."
—Mrs. H. Petruccio; Frackville, Pa.

"Moneysworth is aptly named. To paraphrase Churchill, 'Never have so many paid so little for so much.'"
—D. Alperin; Pittsburgh, Pa.

As you can see, reading Moneysworth is the next best thing to being born rich. It is absolute protection against the ups and downs of economic fortune.

The price of a 32-Week Introductory Subscription to Moneysworth is, as we said, **ONLY \$2.99!** And you get **YOUR PIECE OF THE PIE: How To Cash In On Food Stamps—ABSOLUTELY FREE!!**

To enter your subscription, simply fill out the coupon below and mail it, with payment, to: Moneysworth, 251 W. 57th St., New York, N.Y. 10019.

Get your copy of the food-stamp guide today. You're entitled to a piece of the pie—even if you're upper crust.



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EXTRA BONUS OFFER: Check this box ☐ enclose \$5 and get A **WHOLE YEAR** of Moneysworth, plus a copy of the food-stamp guide, and a copy of the booklet all of America is talking about, "Stake Your Claim! How to Work the Social Security Gold Mine."

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This is not a dangerous acid or a coverup, but a newly developed and patented product that eliminates existing rust with a simple brush application.

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Order today and stop watching rust eat a hole in your pocket.

7 oz. container will eliminate 50 square feet of rust. Send \$4.00 (includes postage and handling) to:

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AUTO-REPAIR COOPERATIVE

(Continued from page 30F)



Old crankcase oil poses a disposal problem. William Cooney pours it into his home oil-burner tank to be burned.

the dirty crankcase oil which was accumulating. Bill Cooney came up with the answer.

For 25 years Cooney has been discarding oil he's been draining from his cars into his home's oil burner fuel tank. The relatively small quantity of crankcase oil mixes with the No. 2 fuel oil and is burned.

"Never had a problem with my oil burner," Cooney says, which is one reason he changes oil so frequently ... twice a month for the Volkswagen and once a month for the Chevy.

"It's good for my cars, and I don't pollute by dumping it," he states.

Co-op home repairs, too

The cooperation exhibited by members of the co-op extends beyond auto repair to home repair. They have purchased equipment and tools designed for the house.

Members, for example, collectively do their own appliance repair. In relating experiences in this area, Rosenberg unconsciously summed up for me the underlying philosophy of the Massapequa Mini-Co-op when he said, "Very few repairmen ever set foot in any of our homes."

This philosophy has resulted in co-op members saving themselves a lot of money, while at the same time allowing them to pay the kind of careful attention to their cars and homes which no stranger, bearing the title "professional," would give. ★★

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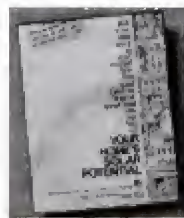
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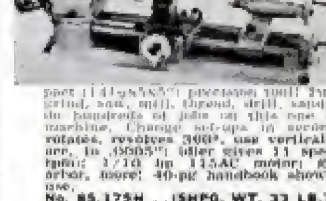


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ALL OUTDOORS

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Where the action isn't

Mid-season crowding at Yellowstone, Yosemite and the Grand Canyon is no secret, but many other national parks, monuments, memorials, recreation areas and even seashores are almost unknown—and unvisited. Ever hear of exploring the caves, hiking the nature trails, visiting the museum or camping at Lava Beds National Monument at Tulelake, Calif.? How about Pinnacles National Monument, John Muir National Historic Site or Channel Islands National Monument (with its scuba diving, primitive camping and fishing) in the same state?

Florida is another visitors' mecca, but do you know its DeSoto National Memorial, Fort Matanzas National Monument, Fort Caroline National Memorial on the Gulf Islands National Seashore? These, plus 35 other states and the Virgin Islands have little-known National Park Service attractions, many with camping facilities and a number near National Forests and state parks as well.

And now, a search mission is no longer necessary to locate an unspoiled park with plenty of room. The National Park Service has published a 44-page, 60-cent booklet, *Visit A Lesser-Used Park*, that lists hundreds of uncrowded spots from among the 286 areas it administers. The booklet is available from the Government Printing Office, Washington, D.C. 20402. Details about any location you choose can be requested by mail from the addresses given in the booklet. It makes bargain reading for off-season study.

The bigger picture

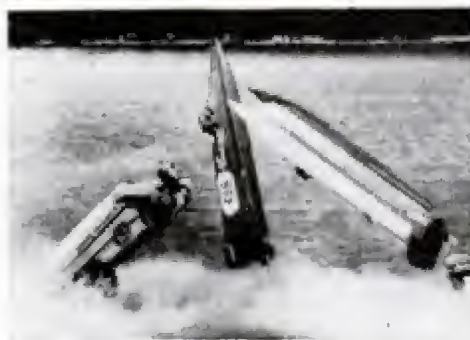
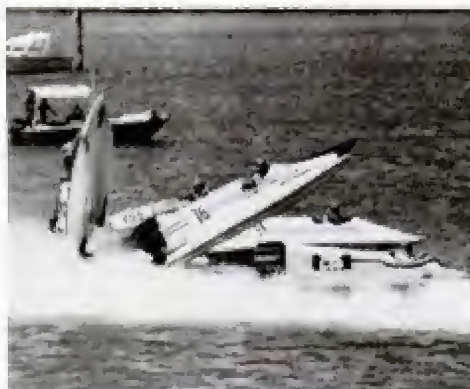
The recent TV feature, *Guns of Autumn*, managed to show nonhunters what was bad about the sport—and how any activity with about 25 million participants is likely to include a lunatic fringe. What was omitted was a study of the reasons these same millions of us enjoy the outdoors.

Hunters are the ones who pay the excise taxes and license fees which make possible wildlife management, proper limits on game, and the protection and care of animals and birds that will never be hunted. The average hunter is in favor of the strong

restrictions that outlawed market hunting long ago, and wants the necessary restrictions today to keep the sport a sport.

But any true picture of hunting must also show long pleasant days afield when no shot, perhaps, is fired and a family simply enjoys the out-of-doors. Remington's excellent loan film for clubs, "A Question of Hunting," tries to explain some of this while covering the pros and cons of the sport.

Fishing, mountain climbing, camping, snowmobiling—almost any activity can be shown in a bad light. To get the full view, it is necessary to see both sides.



Flying-speed power—that's the strength of next year's new six-cylinder outboards, as these racing prototypes showed in this spectacular multilap sequence during OPC Nationals at Miami's Marine Stadium. Miami-Metro photog Dan Cowan got the action; three drivers received only bruises,

Race for racers

This month—on Nov. 29th—12 of the world's top boat drivers are scheduled for an unusual test at Miami's Marine Stadium. Selected by unlimited ace Bill Muncey from among international hydroplane, off-shore, closed-course and marathon class champions, the drivers will be put in identical tunnel hulls with Evinrude powerplants. Final test will include three 10-lap heats with drivers exchanging boats after every heat. The winner is likely to be the best there is.

Steel-load safety

Because ducks insist on eating lead shot and getting poisoned by it—and because designated federal and state areas along some flyways now require that hunters use steel shot instead—reloaders must follow some new rules. Recommendations from the Sporting Arms and Ammunition Manufacturers Institute advise special cautions for do-it-yourself loaders making the switch to steel. A number of reloading details are still in the development stage, but latest pointers include:

1. No components (shells, powders, primers, wads, pouches) other than those specifically recommended as suitable for steel-shot shotshells should be used in handloading.
2. Steel shot should not be substituted for lead shot in factory-loaded shells of any gauge.
3. Steel shot for shotshells is specifically designed for them and is considerably softer than air rifle shot, peening shot, ball bearings and other common steel-ball products. None of these others should be used in place of the proper steel pellets in shotshells; many are much harder than shotgun barrels and could cause damage.
4. Steel shotshell components should not be used for lead shotshell reloading unless specifically so recommended by the manufacturer.
5. Special shot pouches, collars and other protective means of insulating steel shot from the barrel wall during firing are essential to prevent barrel damage, and conventional lead-shot pouches are not adequate for steel.
6. Steel plates or other hard-sur-

(Please turn to page 161)



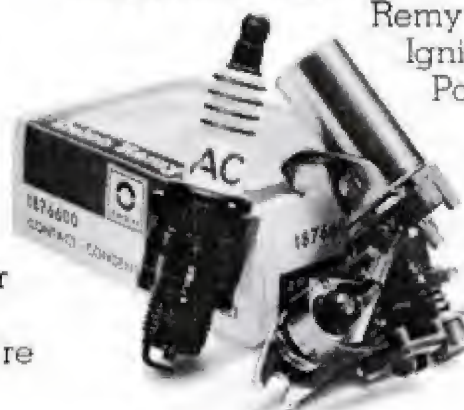
Worn spark plugs can cost you money. New AC Spark Plugs can help save you money.

Worn, misfiring spark plugs can cost you plenty — in terms of money spent for wasted gasoline.

So if you're not getting your money's worth from your gasoline, it's a good idea to go under the hood and pull one of your plugs. It'll probably give you a good indication of how your ignition system is doing.

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due for a tune-up, go with the names you know, AC Fire-Ring Spark Plugs and Delco-Remy Ignition Parts.



There's an AC-Delco Tune-up Team engineered for your car and your kind of driving, designed to work together to help you get the mpgs and smooth performance you should be getting.

So tune up and go with the names you know. AC-Delco. You'll feel the difference on the highway, and at the gasoline pumps.

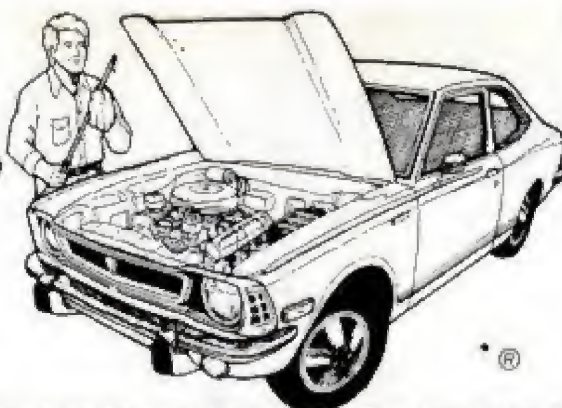
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important preventive maintenance tool you can own. The MOTOR OIL TESTER* will pay for itself if it saves just one oil/filter change. It may even save your engine. Either way it has to be the best and least expensive engine insurance you can buy. The kit contains sufficient supplies to test two cars for one year. \$6.95 + \$5d postage & handling. California residents add 6% sales tax.

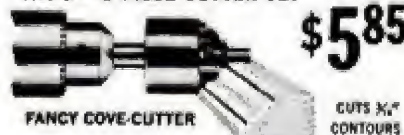
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HINTS

FROM READERS

Opening chain links



To open heavy chain links, I've found it practical to insert the head of a pair of pliers in the link and turn a large screwdriver blade against the flat surface.

—Richard Braithwaite, Hatboro, Pa.

Less messy oilcan



An oilcan gets messy pretty fast, and soon you can't set it down without leaving a ring. A felt washer over the spout will catch drips and leave the can clean.

—Ken Patterson, Regina, Sask.

Bandsawing cylinders



Deep, hollow wood cylinders can be cut with a bandsaw if hollowing out is done with a sharp-angled entry cut tangential to the cylinder's inside circumference. Thin veneer can then be glued into the blade kerf to close the cylinder solidly.—Rosario Capotosto, Greenlawn, N.Y.

If this isn't one of the most incredible tool inventions of the century, our name isn't Black & Decker.

It's called the Workmate!™ It's part bench, part vise. It's lightweight, portable and remarkably strong.

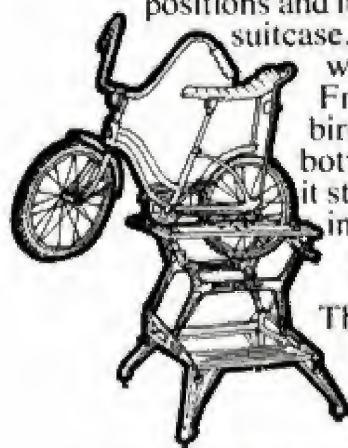
It holds up to 350 lbs. of dead weight, it's got an incredible variety of clamping positions and it folds up to the size of a suitcase, so you can tuck it away when you're not using it.

From the top of its laminated birch-ply work surface to the bottom of its sturdy steel legs, it stands practically unrivaled in ingenuity and cleverness of design.

The Vise Jaws and Clamps

The top of the Workmate is, in effect, a giant 29"-long vise. The jaws are controlled by two separate clamps that work

independently. This means you can open one end wider than the other to hold an irregularly shaped object, like a bicycle. An extremely handy feature. (Another handy feature is the V-groove in the vise jaws, for firmly clamping pipes.)

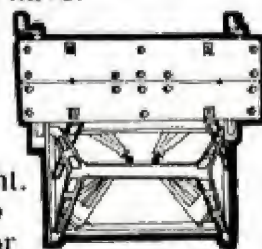


The Swivel Pegs

There are 20 holes in the Workmate's top. These holes are "stops" in which swivel pegs are placed. Because the pegs turn to grip at any angle, you get an adaptability of clamping positions most regular workbenches don't have.

The Frame

The Workmate's frame is a combination of steel and die-cast aluminum. Its skeletal quality gives it great strength, but surprising lightness in weight. It can be easily carried from job to job. The bottom legs fold in or out, giving you a choice of two working heights. And, of course, the whole frame folds up completely, for amazingly handy storage.



The incredible Workmate. Only from Black & Decker.



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A really good hi-fi for under \$230

What's the secret?
It's monophonic.



Advent's new, \$125 FM radio sounds so good it's a pity to waste it just on FM listening—especially when, for just about \$105 more, you can turn it into an equally good phonograph.

Getting a phonograph signal into the Advent looks easy: There's an input jack on the back with a switch so you can listen to FM or the input at will. But you can't feed a magnetic phono cartridge (needed for good sound and low record wear) directly into it. You have to use a preamplifier between the cartridge and input to get enough sound and to correct the balance between bass and treble. But you don't need a hi-fi component preamp: An \$11 one like Lafayette's 99 F 02198 does fine.

Advent's 2-piece, \$125 FM radio (above, right) becomes a really good monophonic radio/phonograph system when you add a Garrard changer module (about \$80), a Lafayette phono preamp (\$11), and a Y-connector (about \$1.85).



For a turntable, we used a Garrard 42M, including cartridge and base; it's been replaced by the 440M, with improved tone arm, for \$80. The cartridge with either Garrard is a stereo type, so you can play stereo records without damaging them. But since it has two channels of output, you also need a Y-connector (Lafayette 99 F 00937 or 99 F 00903 or equivalent) to funnel both channel signals to the Advent's one-channel, monophonic input. Connect the Y between cartridge outputs and one preamp input—combining the preamp's outputs may damage its circuitry. You'll need a cable from the preamp output to the Advent's input jack. To stop hum, attach the green ground wire from the phonograph to any screw on the preamp case.

The volume is a bit limited—some portable radios sound louder, though not as good—and you forego the depth and directionality of stereo. But within these limits, you'll find this a very nice little hi-fi.—*Ivan Berger*

Connections are simple. Phono leads go into Y-connector which feeds one channel of preamp; output of that channel feeds the Advent radio's input jack (its other jack is for tape output). The green ground wire goes to any screw on the case of the preamplifier.

Don't have a silent night this Christmas.



The Bell & Howell
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Capture both the sights and sounds of Christmas this holiday season. With a Bell & Howell Filmsonic™ super 8 sound movie system.

With the Filmsonic cameras and projectors, sound movies are no longer a novelty. Not when you see and hear how easy it is to get professional-quality results.

This year, find out for yourself. Before it's too late. Because the real spirit of Christmas isn't just what you see. But also what you hear.

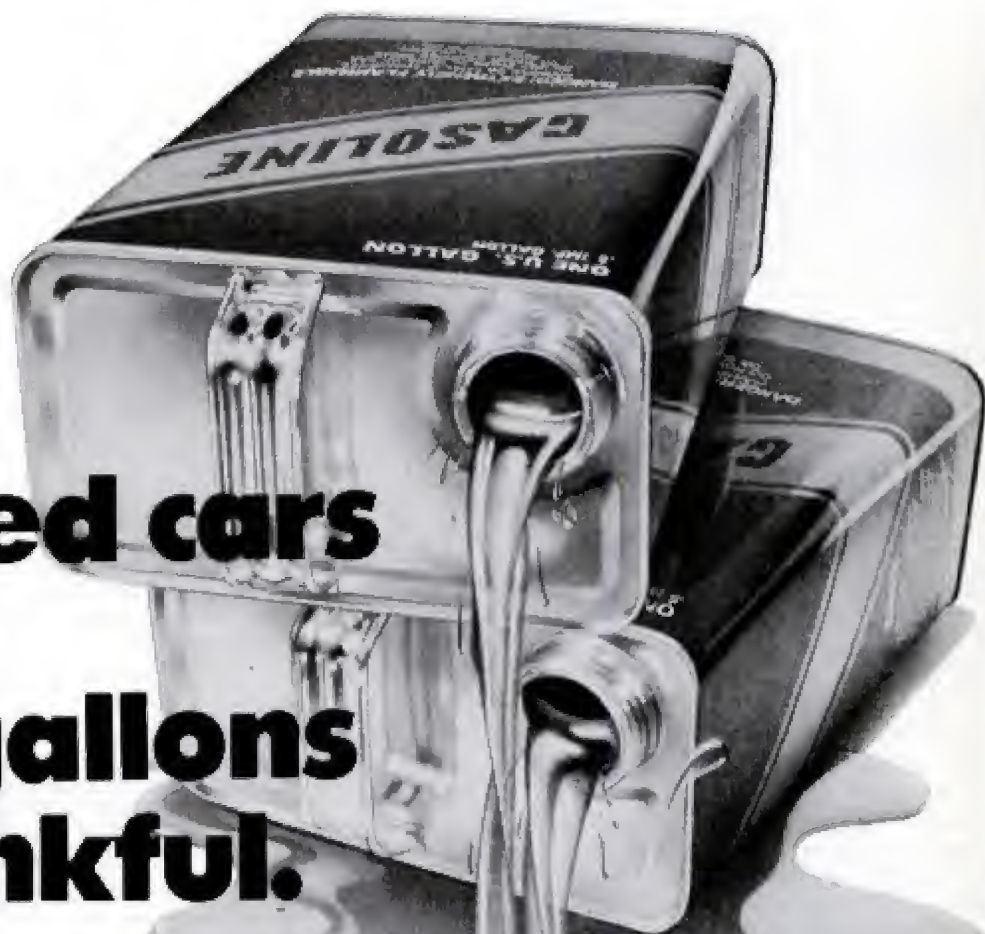


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You're paying for a tune-up whether you get one or not.

Untuned cars waste 1 to 2 gallons per tankful.



Before you think, "They're not talking to me," read the next sentence.
3 out of 5 cars on the road today need a tune-up.

That means there's a good chance we are talking to you. Especially if it's been
10,000 miles since your last tune-up.

A tune-up with Champion Spark Plugs can help save you that one to two gallons
per tankful (depending on the size of your tank). To say nothing of giving you surer
starts and better engine performance all winter.

Gasoline is just too expensive to waste. So get your
car back in tune. Take it to your mechanic and say
"Fill 'er up with Champions." Then you won't have to
say "Fill 'er up with gas" nearly as often.



Fill 'er up with Champions.

SCIENCE WORLDWIDE



Blimey, but it's a big one!

The development of oil fields in the North Sea, where drilling sites tend to be in deep water and the weather rambunctious, requires powerful, outsized equipment. *Graythorp II*, said to be the world's largest drilling platform, was recently towed from the Laing Offshore yard near Hartlepool, England, to a site in Britain's "Forties" oil field.

Supported by special barges and towed to sea on its side, the platform was dropped into position after a 250-mile trip and anchored to the seabed with steel pilings. *Graythorp II* measures 470 feet from base to top and weighs some 20,000 tons. When outfitted with deck sections and a drilling derrick, the platform will reach a height of 690 feet.

Protein from tropical bean

An obscure tropical plant—the winged bean—has the potential to become a major protein-producing crop in areas of the world where protein is desperately needed. So states a report recently issued by the National Research Council, a scientific advisory group to the federal government.

Almost identical to the nutritious soybean, the winged bean's seed averages 34 percent protein and 17 percent oil. Its foliage is used both as a leafy vegetable and a healthful animal feed, and the 20 percent protein content of its slightly sweet-tasting roots far surpasses the two percent of potatoes and other root crops. The

plant now grows abundantly in Southeast Asia, but the rest of the world seems unaware of it, the Research Council report states. It should be possible to grow the bean in protein-hungry areas in Central and South America, Africa, the Caribbean and West Asia. The soybean has not adapted well in these regions.

Coal field in Massachusetts

New England, more dependent on imported fuel than any other U.S. region, has an untapped energy source, reports the Federal Energy Administration. Under the crust of southeastern Massachusetts lies what could prove to be one of the largest deposits of anthracite in the country, say FEA officials. Recent tests by the Bureau of Mines indicate the coal has a low sulfur content and a relatively high heating value. Presence of coal in the Bay State has long been known, but the last major survey of the area was made in 1947. If the quantity and quality of the deposit are confirmed by extensive core drilling, benefits to the Northeast could be significant, says the FEA.

Speak softly to your plants

Though plants may respond to an occasional kind word, as some gardening enthusiasts claim, they do not like excessive noise. This was recently determined by researchers at Drexel University, Philadelphia, in an experiment with 12 coleuses, the

popular house plants that have broad, multicolored leaves. After the plants had achieved normal growth characteristics in an environmental chamber, they were subjected to 100 decibels of noise, the level of noise heard in a busy subway station. Within six days, the researchers report, the plants' growth rates had dropped an average of 47 percent. The scientists say that the continuous noise caused a severe water loss through the leaves, stems and other above-ground parts.

Strong but not speedy

Cross a helicopter with a balloon, and what do you have? An Aerocrane. That's the name given the hybrid airship under development at the All American Engineering Co., Wilmington, Del. The craft is said to combine the heavy lift capability of a helium-filled balloon with the maneuverability of a helicopter.

Under a Navy contract, All Ameri-



can has built a 33-foot flying scale model (shown in photo). It's estimated the balloon will support all of the craft's structural weight and half of its slingload. Four wings, each with turboprop engine, extend from the balloon's equator. When power is applied, the entire wing-balloon assembly rotates. Large Aerocranes are expected to attain speeds of about 50 mph.

The primary military mission is seen as containership off-loading in support of amphibious operations. Commercial applications might include timber harvesting and general construction work. An Aerocrane could deliver a fully preassembled house to a building site. ★★

'76 Pickup news from Ford



Newest Ford 4x4

Ford's new 4-wheel-drive F-150 runs on any gas . . . through just about anything! Great for doing a job or for getting away from the mob. Called a heavy duty half-tonner, the F-150 can

actually haul over a ton. Heavy duty features like 4-speed shift and power disc/drum brakes are standard equipment. Options include full-time 4-wheel drive, Cruise-O-Matic.



Extra Durability

Roomy regular-cab pickups have over 200 sq. ft. of galvanizing to protect sheetmetal . . . Twin-I-Beam up front for strength plus smooth ride . . . all-welded Styleside box with smooth coved corners. Ford builds 'em to last!



Roomiest 2-Door

Ford SuperCab is the only 2-door cab roomy enough for a full-width, fold-down rear seat (optional, as are folding jumps). Seats a family of six! See your Ford Dealer.

93 out of 100 of all Ford trucks built in the last 12 years are still on the job (R. L. Polk & Co. figures).

FORD

FORD DIVISION



Model shown is a SuperCab with optional equipment.



BY MORT SCHULTZ

CAR CLINIC

Milky Way

The simulated vinyl wood-grain appliqué on the outside of our 1972 Chevrolet station wagon has taken on a whitish film. What can I do to restore the vinyl's appearance short of replacing it?—Paul Elstein, Worcester, Mass.

Over a period of time, vinyl can attain a milky, frosty or gray appearance as wax or polish is applied and permitted to build up. As you may know, it is best not to wax or polish vinyl, but many people have their cars washed at commercial establishments that use wax in the washing process. This can permeate the vinyl and build up in a thick coating. The film often can be removed by cleaning with a wax remover.

Three such removers specifically recommended by Chevrolet are Prep Sol (DuPont), Pre Kleano (Rinshed-Mason) and Ditzo-440 (Ditzler). You should be able to get one of these at an auto-supply or hardware store.

Posifacts about positraction

Would you please discuss the causes of and cures for chatter in a positraction rear axle? The unit in my Pontiac has started making noise and I am really concerned. Overhaul is very expensive.—Richard Clines, St. Petersburg, Fla.

Overhaul is usually not necessary. The two major causes of positraction chatter, which I define as a snapping or clunking noise that is most obviously heard when you are on slow turns, are:

1. Rear tires that don't rotate the same number of revolutions. This failing occurs when the two tires are not equal in circumference to within approximately $\frac{1}{2}$ inch. It can happen when your car's tire inflation isn't equal, when the tire wear is uneven, when you have different tire brands or sizes on opposite sides, or if there was a variation in the molds used in manufacturing the tires.

2. A breakdown of the antichatter additives put into positraction lubricant—or failure to use positraction lubricant. *You should never use ordinary rear-axle lubricant in a positraction unit.*

To find the cause of your prob'em, first make sure that tire pressure

readings are equal. Then check the circumference of each rear tire around the center tread with a tape measure. If the difference between the two is more than $\frac{1}{2}$ inch, the chattering is probably being caused by the constant slipping of the positraction plates which the difference in tire diameter is creating. You should purchase two tires that measure within the $\frac{1}{2}$ -inch specification for circumference.

If tires don't appear to be causing the chatter, turn your attention to the lubricant. Drive the car until the rear axle gets warm and then drain the old lube. If you have to remove the rear-axle housing cover in order to do this, be certain you use a new gasket when reinstalling the cover. Refill the axle with the positraction lubricant recommended for your car.

In the case of GM cars, the GM positraction Lubricant is available from dealers in one-quart cans (part No. 1051022). When the axle is filled and driven 50 to 100 miles, enough of the new lubricant should have worked in between the plates to eliminate the chatter.

Hot dogs

I have a 1970 AMC Hornet with 302-cu.-in. engine and airconditioning. The heat from beneath the dash on the passenger side is very hot, and I have had to keep the airconditioning running to keep passengers comfortable. Is there a heat shield I can install to cut down on the heat?—William Petersen, Chicago, Ill.

I don't think your car needs a heat shield. Instead, to keep passengers comfortable, I'd see that the heater-control-valve cable is operative and/or the heater-control valve is working. If the valve has failed or can't be closed, hot coolant will continually flow through the heater, dispensing some heat into the car.

Start by making sure the cable is connected and is not kinked. Then, with the heater turned off, let the engine warm up and feel the heater hose. If *both* are hot, the valve is defective. Get a new one.

In the red

The oil pressure gauge of my 1974 Capri registers in the red, but yet I'm experiencing no knock or any-

thing that indicates serious trouble. Do I have a problem or is my gauge bad?—Stanley Caldwell, Kelly AFB, Tex.

I'll bet on a bad gauge since a new one has been issued. You can get it from a dealer using part No. D3RY9273-A.

Should have used restraint

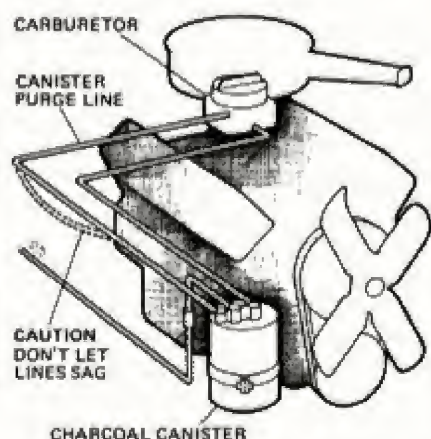
I want to tell you how some bad advice cost me money. My car, a 1974 Mustang II, has the seat-belt restraint interlock system. I mentioned to a friend that I'd like to override the system because to me the belt is confining. He suggested I pull the belt out and loop the buckle onto the door handle. This would override the system, permitting me to start the engine without having to buckle the belt.

Well, it worked like a charm—until I went to detach the belt so I could open the door. Something caught in the belt retractor and I couldn't move the belt enough to get it off the handle. I had to break the

(Please turn to page 44)

Support your vapor hose

If the vapor hose from the carburetor to charcoal canister of a fuel-evaporation control system sags, raw fuel may collect in the dipped area. This can cause the fuel system to load up and make a hot engine difficult to start. The illustration shows a typical way that hoses are routed and cautions you to see that hoses are free of dips.



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Kings, 15 mg. "tar," 1.0 mg. nicotine; Longs, 17 mg. "tar," 1.2 mg. nicotine, av. per cigarette, FTC Report Apr. '75

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Redo it yourself! With Easy-Set ceramic tile.



1 "I used to take baths with my eyes closed. Not because of the soap. It was the bathroom walls. Talk about ugly! I couldn't stand to look at them. But what's a girl to do? I mean on our budget, I couldn't afford to have it redone.



2 "And then I heard about Easy-Set!™ Do-it-yourself *real* ceramic tile, made by American Olean. It comes in wall sheets and handy tub wall kits. In six colors that look great in bathrooms, laundries, kitchens. But the best part was I could do it myself. And save money, too.

"Well, I installed it myself in just a few hours. Right over the old crummy walls. No problem, 'cause Easy-Set goes up over plastic, plaster, tile, you name it. I got the Easy-Set sheets, and just followed the simple directions. And I'm no handyman, know what I mean? I could even get the supplies I needed right where I got the tile.



4 "Now I sit and soak for hours. Imagine! Me, with real ceramic tile walls. Not only that, but Easy-Set has this special smooth grout—the white stuff between the tile—that wipes clean as easy as the tile. So my walls stay looking new and terrific. Easy-Set. The do-it-yourself ceramic tile. It sure opened my eyes!"

Look for Easy-Set* at the stores listed on the opposite page, or check your local dealer. West of the Rockies, ask for Mod-U-Tile.*

**Patent Pending*

American Olean Tile Company
2168 Cannon Avenue, Lansdale, Pa. 19446

- ☐ Please send free information on Easy-Set do-it-yourself ceramic tile, including the latest list of dealers near me.
- ☐ I like the idea, but I'm not a "do-it-yourselfer." Please tell me who can install tile like Easy-Set for me.

Name _____

Address _____

City _____

State _____

Zip _____

**American
Olean**
A Division of Fabrol Corporation

handle to open the door. I now understand that certain things are best left alone, so just sign my name Poorer but Wiser from Milford, Pa.

There was an easier way to rectify matters: You could have removed the handle. Anyone wishing to override the interlock system in 1974 and some early '75 models can now do so legally. A recently passed law leaves the decision of retaining or eliminating the system to the car owner.

In the case of your Mustang II, you can do away with the interlock by pulling the quick-disconnect plug you'll find beneath the driver's seat and disconnecting the sensor beneath the passenger seat.

P.S.: I can understand the rationale for disconnecting the interlock system, but if you don't wear the belt you're taking dangerous chances. You can be wiser and poorer, but you can't be wiser when dead.

Heigh-ho, Colt, and away!

No one has been able to find out why my 1972 Dodge Colt stumbles on acceleration when the engine is warm. Other than this, my car is the best used car I have ever brought. Please help me.—Sam Frankel, Silver Springs, Md.

If your Colt is like others, the faulty acceleration is probably being caused by a concentration of excessive heat forming on the accelerator pump body.

But no sweat. The trouble can be rectified by installing an accelerator-pump body-cooling kit, which you can get from a Dodge dealer under part No. MD 005086. Here is how to install the kit (no smoking and no open flames, please—I need all the readers I have):

1. After taking off the air-cleaner assembly, disconnect the fuel return hose at the fuel pump and cut off about seven inches of the hose.

2. Remove the four screws holding the accelerator-pump body and install the main body of the cooling kit between the carburetor body and the accelerator pump. A spring and plate may be holding the cooling kit in its package, but these are used only for shipping purposes, so you should discard them.

3. Install the hose that comes in the kit package between the fuel pump and the cooling-kit-inlet fitting, and then attach the fuel-return hose to the cooling-kit-outlet fitting. Make sure that the holding-clip fasteners are tight. Reinstall the air-cleaner assembly and just watch that Colt run.

Battery banter

In looking over the specification of the owner's manual for my 1975 Pontiac LeMans I learned that my battery has a cold-cranking capacity of 350 and a reserve capacity of 80. What do these mean?—Jack Dee, Syracuse, N.Y.

The cold-cranking rating is the amount of current (amperes) a battery can deliver for 30 seconds at 0°F, while maintaining a terminal voltage of not less than 7.2 volts, which is the amount of voltage that's considered necessary for starting. The reserve capacity rating represents the time in minutes it takes a fully charged battery's terminal voltage to fall below 10.2 volts at a continuous discharge rate of 25 amps. at about 80°F. This is a straight draw imposed on a battery at a time when it is not receiving any input from the charging system.

You're probably wondering what this means to you, so let me try to boil it down. The cold-cranking rating was devised to let you select a replacement battery which will meet your car's electrical needs. Any battery that you buy in the future for this car should have a cold cranking

rating stamped on it of at least 350 amps. at 0°F. The starter draw on this battery will be less than 350 amps. when the ambient temperature is greater than 0°F. and more when the ambient temperature is lower than 0°F., but some median had to be used and 0°F. was selected. With this battery, accordingly, your engine will start within 30 seconds at 0°F. if the engine is in good mechanical condition and if the battery is adequately charged.

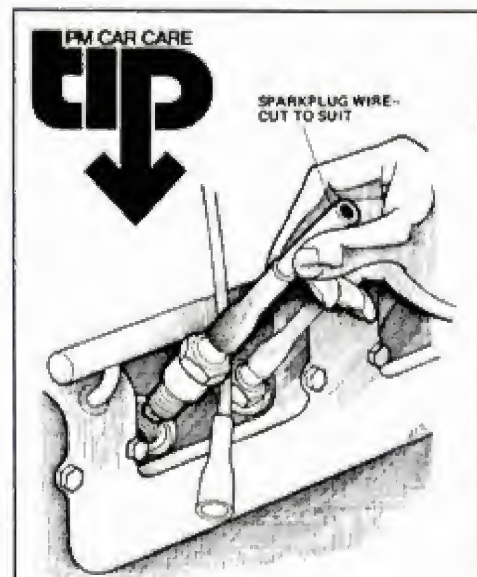
The reserve capacity rating prevents nervous breakdowns. Suppose you're driving along and your car's charging system goes blooey. The alternator warning light flashes on or the ammeter needle drops to zero. By knowing you have a reserve capacity of 80 minutes (it too, should be stamped on the case), you know you have about this much driving time solely on battery power. Of course, you should shut off all unnecessary loads (such as the air-conditioner and radio) and get to a service station or garage for repairs as soon as possible.

SERVICE TIPS

■ If the alternator warning light in your 1971-75 Dodge Colt does not go out at low speeds, or the light stays on too long, don't get involved with intricate charging tests without first inspecting the heater blower motor fuse. A hairline crack in the fuse can be causing the trouble, which is easily fixed by replacing the fuse with one of the same rating.

■ When it's time to replace your original battery in a 1975 Oldsmobile Starfire, don't go by the label on the battery. It may tell you to replace with a Delco Y-87 or R-87, but if you do this you'll find there won't be sufficient clearance over the battery caps to let you close the hood. To replace with a Delco, the right one is a Y-87PT or R-87PT.

■ Good advice this month from Chevrolet on how to take off a tough-to-remove wheel: A wheel can wedge on if light rust or a tight fit exists between the wheel center hole and axle or rotor. Retighten all lugs; then loosen each a turn or two. Lower the car to the floor and rock it slowly from Drive to Reverse, applying moderate braking pressure until the wheel loosens. Raise the car, remove the lugs and take off the wheel. ★★



You'll get a boot out of this

To keep from burning your hands on a hot engine and to start a sparkplug into its cylinder when clearance is limited, use an old sparkplug lead. Insert the plug tightly into the old lead's boot. The tight fit will hold the plug firmly, allowing you to get the plug started in its port. The flexible lead also permits you to maneuver in any direction necessary.

GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

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New Automobile Intrusion Alarm Kit

Total Protection. Alarm mounts anywhere; connects to switches on doors, hood, & trunk. Underdash switch arms or disables unit. Adjustable delay time allows you to quickly enter or leave car without triggering alarm, but opening trunk or hood triggers alarm instantly. Alarm sounds car horn in repeated 2-minute cycles. Kit GD-1157 Alarm \$24.95; Kit GDA-1157-1 Siren (gives yelping sound louder than car horn) \$19.95.



New Programmable Digital Stop Watch Kit

Another "first" from Heath. 2 IC counters, 8 digits & 7 functions with typical accuracy to $\pm 0.003\%$ and resolution to 1/100th of a second. Function 1 (Start/Stop Elapsed) times individual events while also counting total. Function 2 (Sequential) times each part of event & displays each separately while timing overall event. Function 3 (Total Activity) accumulates total elapsed time of a series, excluding time between events. Function 4 (Split) displays cumulative time to each "split" point while continuing overall event time. Function 5 (Start/Stop Activity) shows separate time for each event & totals all individual times. Function 6 (Programmed Upcount) counts up to "learned" time. Function 7 (Programmed Downcount) counts down from "learned" time. Stop watch can "learn" time from other functions or be programmed up to 9 hours, 59 minutes, 59 seconds. Has jacks for external triggering devices and alarms. Includes nickel-cadmium batteries & charger. Kit GB-1201, \$99.95.



New Digital Wind Speed & Direction Indicator Kit

Unique. Two big, bright digits show wind speed to 99 mph. As you build, choose 2 readout modes; miles, knots, or kilometers per hour; front panel light shows mode in use. 8 incandescent lights show wind direction at principal compass points; adjacent lighted bulbs give 16 point resolution. Remote transmitter boom clamps to TV mast. Styled in black plastic to match Heathkit GC-1005 Digital Clock and ID-1390A Digital Thermometer. Kit ID-1590, \$69.95 less cable.

New — Two-Way Telephone Amplifier Kits

Now, hands-free telephone use with amplified "talk" and amplified "listen" — with or without dialer. Talk & listen from 10' away. Voice-actuated circuitry switches from talk to listen without feedback or clipped words. Listen button lets you monitor line without built-in microphone activated. Dialer model may be used with or without regular telephone. Includes 4-prong jack & phone coupler connector. Battery powered. Kit GD-1112 (no dial) \$49.95; Kit GD-1162 (w. dial) \$69.95.

New Public Address Sound System Kits

Outperforms those costing twice as much. TA-1620 Control/Amp. takes 6 low impedance mikes, each with level, bass & treble controls & reverb sw. Has VU meter, 4 switched response "shaper" circuits, exclusive bass filter, 100 rms watts drives 2 speaker columns. TA-1625 Booster Amp. 100 rms watts to drive 2 extra speaker columns. TS-1630 Speaker Column. Six 8" full-range drivers response tailored for voice; 60 watt rms rating; 12 ohm impedance. Kit TA-1620 \$449.95; Kit TA-1625 \$179.95; Kit TS-1630 \$199.95.





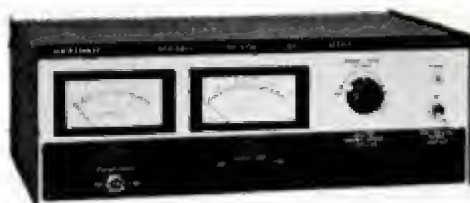
New DC-5 MHz Triggered Scope — Kit or Wired

Best scope value today. Wide bandwidth, 20 mV sensitivity, & stable triggering — ideal for TV, audio and RF servicing. Easy-to-use controls. Trigger circuit (not recurrent type) has normal & automatic modes, switched AC & DC coupling, & front panel external inputs (special TV position allows low freqs. to pass while rejecting high freqs. for easy triggering on complex TV signal). 7 calibrated time bases from 200 ms to 0.2 μ s/cm. 20 mV/cm vertical sensitivity with 9 calibrated attenuator positions up to 10 v/cm, plus variable control. 5" round flat-face CRT (8 x 10 cm graticle). Lightweight, durable blue plastic cabinet with white panel. Kit IO-4540 \$179.95; Assembled SO-4540 \$275.



New — Lowest cost Triggered 5 MHz Scope Kit

The scope everyone can afford, and it has the performance you need. DC-5 MHz band width, 100 mV vertical sensitivity with X1, X10 & X100 attenuation, AC or DC. Automatic, positive locking horizontal sweep continuously adjustable from 20 ms to 200 ns/cm. Stable displays due to zener regulated amplifiers and sweep. 5" round flat-face CRT with 8 x 10 cm graticle. Simplified controls and switches make it easy to use. Lightweight, durable blue plastic cabinet; white panel. It's the best instrument buy in years. Kit IO-4560 \$119.95



New Variable Isolated AC Supply

What every tech & hobbyist needs. The IP-5220 isolates equipment under test from the AC power line and provides an AC output which is variable from zero to 140 volts. Great for locating circuit faults caused by high or low voltage or testing equipment with unknown power requirements. Power rating is 360 volt-amperes, continuous. Variable output current rating: 3A. max. Direct output current rating: 10A. Two meters: voltmeter 0-150 VAC; ammeter: 0-1 & 0-3A. Ammeter and variable output socket are fused. Kit IP-5220, \$109.95



New Oscilloscope Calibrator Kit

For time calibration, it generates a 0.5 second to 1 μ sec square wave in 1-2-5 sequence accurate to 0.01% with 200 mV peak ($\leq 3\%$ overshoot) and ≤ 4 ns rise time. Voltage calibration ranges are 1 mV to 100 v. in decade sequence, accuracy within 2%, DC plus variable 2 Hz to 10 kHz in 1-2-5 sequence (internal std. accuracy within 1%). Use it to calibrate scopes up to 35 MHz and voltmeters; it's also a fast rise time squarewave generator and good bench freq. standard. Kit IG-4505 \$44.95

New 21" (diag.) Digital Design Color TV Kit

All the advanced technology of digital circuitry in a smaller screen size. Electronic touch-to-tune varactor front end (nothing mechanical to wear out) with computer-like programming board for up to 16 channels. **On-screen channel numbers**, adjustable in brightness, position, and duration. **On-screen digital clock**; a low-cost option; programmable in 12 or 24 hour format, displays 4 or 6 digits. **Fixed-filter IF**, a Heath exclusive that assures better pictures longer, never needs instrument alignment. **100% solid state** — more ICs than any other — sophisticated circuitry that results in less interference, better color tints, improved sensitivity, greater noise immunity, improved picture definition. **Black negative matrix 21V picture tube** for brighter, sharper pictures. **Total touch-tune remote control** — low cost option that operates all functions, including recall of time & channel.



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DETROIT LISTENING POST



BY ROBERT LUND

GM working up van-wagon

General Motors is developing a new type of vehicle to introduce in 1979. It will be a combination station wagon and van—larger than a wagon; smaller than a van. The project is just under way and GM hasn't decided on a name to describe the new configuration to distinguish it from a regular wagon or van. As for styling, GM will go for a utilitarian look, emphasizing practical instead of pretty. In an effort to keep the project under wraps, some preliminary design work is being done outside the Detroit area. Chevrolet would be the logical division to handle the car, but that hasn't been confirmed.

New cars for AMC, Pontiac

American Motors has now green-lighted the station-wagon version of Pacer for next fall, while GM has reportedly given the go light to a Pontiac Chevette as soon as the tooling is ready. The Pon-Chev isn't official, although Pontiac has confirmed it is testing a 151-cu.-in. four-cylinder engine for its smallest cars.

Ford mini for '77 or '78

The earliest you will see a Ford mini to counter GM's Chevette will be the fall of 1977. If the car isn't ready by then, it will be a mid-year entry in the spring of 1978. Ford is pushing for the earlier date, but much depends on company projects in Germany and Spain. First version of the vehicle will be put together in Germany, but with content supplied by Spain and the United States.

GM move could cut repair cost

There's a private row going on between Detroit, car dealers and non-dealer body shops that might not seem of much interest to outsiders. Depending on the outcome, it could cut the cost of repairing a banged-up car.

If you clobber your car to a point where the sheet metal can't be repaired and has to be replaced, you can take the car to a dealership or a nondealer body shop. All things equal, one place will do as good a job as the other. Prices are about equal, too.

If you take the car to a nondealer shop, the franchised dealer will still get a rake-off on the job, because nondealer shops can't buy replacement sheet metal direct from car-makers. The factories won't sell to them. Nondealer outlets have to buy the sections through franchised dealers. The franchised dealer gets a markup for his time and trouble and the car owner pays the bill. Dealers have the business locked up and if you don't like their prices, tough luck.

GM wants to cut out the middleman and sell direct to all comers. GM dealers and the National Automobile Dealers Assn. are up in arms—they'd lose the money they make selling to independents. Ford, Chrysler and AMC dealers aren't happy either, because if GM opens its doors to outsiders, it's only a matter of time until the other companies follow suit.

The issue will probably wind up in court. Assuming GM wins, it could make for some new and needed competition that will reduce the cost of repairing an automobile.

More legroom in back of '77s

Company insiders at GM, Ford and American Motors who have seen "bucks" (mock-ups) of the '77 and beyond cars say there is a move on to provide a lot more legroom in the back seat without stealing space from the trunk. This is accomplished by moving the front seat forward, instead of pushing the back seat rearward. A GM source says a six-footer will be able to sit erect in the back of GM cars and still have an inch or two of clearance between his knees and the back of the front seat.

New theory on cause of rust

Does something other than salt, grime and the elements cause cars to rust out? Could be. There's a report circulating inside GM speculating that rust may begin—emphasize *begin*—as a result of dissimilar metals rubbing against each other. The theory is that friction caused when the metals come in contact with each other sets up a chemical reaction that creates a condition making certain metals susceptible to rust.

GM has tested the theory by mak-

ing parts of dissimilar metals, then out of identical metals and subjecting the pieces to various tests. There was no problem with parts made of the same metals, but the others showed a proclivity to rust. It would be practically impossible to build a car, except at prohibitive cost, without dissimilar metals coming into contact with each other. But if GM is on the right track, it wouldn't be much of a trick to coat or treat parts prone to rust to overcome the problem.

Chrysler aids do-it-yourselfers

The car companies have thousands of people and hundreds of departments you never hear about—people deeply involved in designing and building cars who never get their names in print. These guys really know what's going on and I like to listen to them. They don't necessarily like to talk to me, at least not for attribution, because if they say something the company doesn't want known, they could get in trouble.

I ran across one such department at Chrysler last month. It has an unwieldy name—vehicle serviceability committee. The committee is made up of 15 experts in just about every phase of the business except sales. Their job is to study Chrysler products three to four years before the cars go in production to make sure the cars will be easy to service and to prevent service goofs. Like having to pull the engine to replace a spark-plug, a mistake a Chrysler competitor made last year.

I asked Bob Rarey, an engineer who heads the committee, what Chrysler is doing for the do-it-yourself mechanic.

"Our assignment is to make the car easier to service for the professional mechanic," Rarey replied, "but there's a rub-off benefit for the do-it-yourselfer. One of the things we're trying to do is eliminate special service tools. The Mickey Mouse stuff. Expensive, one-of-a-kind tools used for only one job on one car. We want to build the cars so they can be serviced with standard tools, so the same tool used last year can be used this year, next year and the year after. We think that's a benefit for the do-it-yourself mechanic." ★★ ★



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Emperor Clock Company, world's largest manufacturer of grandfather clocks, made it easy for thousands to build their own heirloom clocks starting with the Emperor do-it-yourself case kit. Now, for the first time, Emperor makes it even easier by cutting all miters with newly acquired precision equipment. There's no guesswork involved with the Emperor case kit. All kit pieces have been accurately crafted, pre-cut, and factory sanded for easy assembly. Swan neck divided crown, decorative finial, waist and dial face doors, dial frame and sculptured base-front have been pre-assembled. This means anyone can build his own heirloom. Complete hardware and assembly instructions furnished. Each piece may be reordered separately. No woodworking experience necessary.

Build The Christmas Gift With An Heirloom Destiny. What a wonderful Christmas present for yourself, your family, or treasured friends! The timeless and classic design of the Model 120 is a perfect complement to the flawless beauty of solid $\frac{3}{4}$ " black walnut. Its regal lines are highlighted by four full-turned hood columns and swan neck divided crown with decorative finial. Curved arches appear on the dial face door, full-length waist door and recessed base panel. Emperor's Model 120 is a treasure destined to become an heirloom, a Christmas gift to be remembered for generations.

MONEY BACK GUARANTEE

If for any reason you are not completely satisfied, return in original shipping carton within thirty days for prompt refund... no questions, no excuses.

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When received at our plant all Emperor movements are thoroughly inspected and tested in our quality control room by factory-trained clocksmiths. This insures lasting accuracy and dependability.

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MOVEMENT CARRIES A FULL 1-YEAR WARRANTY

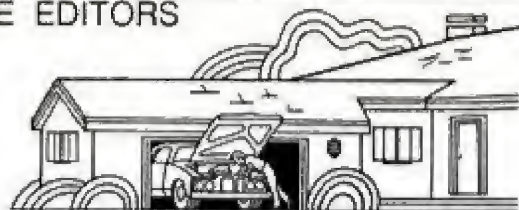
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THE PM GARAGE



Patching made perfect

In my station wagon, the top edge of the back seat takes a beating: Every time it's folded forward to open up the full length of the cargo area it gets mashed. It was scuffed and ripped from years of hitting and



rubbing against the stops that it rests on.

I finally got smart and figured I'd better protect it from further deterioration—before it was too far gone to save at all. I used one of Arno's AutoAids: an interior patch tape. It's a plastic-coated cloth tape that's available in a range of colors. I ran two strips across the length of the seat. It looks neat and it's holding up beautifully. Arno Adhesive Tapes, Inc., Michigan City, Ind. 46360.—*B.H.*

Bull Bag

Skeptics, take note. The Bull Bag does work.

It's a pneumatic auto jack that uses exhaust gas to inflate a tough, barrel-shaped neoprene bag. Slip the bag under any corner of a car, hook the hose to your exhaust pipe via a rubber funnel, idle the engine and within 30 seconds you've got a wheel up off the ground.



Load capacity is 3000 pounds; you can lift a whole axle if you want. I hear fire departments are using Bull Bags for rescue work. A one-way valve holds the bag taut; to release pressure you simply twist the valve at the hose connection.

Two reservations: 1. If your car's exhaust system has holes in it or is weak (rusty), you'll blow it out and/or won't be able to inflate the Bull Bag.

2. Put some scraps of carpet above and below the bag before inflating; although its skin is plenty tough, sharp projections might puncture the bag.

Suggested price of the Bull Bag is \$59.95 at most auto-parts stores, or write Bull Bag West, 29000 South Western Ave., Suite 409, Los Angeles, Calif. 90732.—*M.L.*

Speedy Auto-Flator

This little compressor plugs into the cigarette lighter of any 12-volt car and pumps up to 60 p.s.i.



I let all the air out of one of my car tires, and it took the Auto-Flator only eight minutes to get it back to 26 pounds. This minicompressor seems ideal for inflating bike tires, air mattresses, toys, pneumatic jacks, as well as for on-the-road tire-pumping.

The Auto-Flator draws about nine amps., so it's best to run your car engine at fast idle when inflating tires. After 10 minutes' running time, the piston-type compressor gets too hot to touch.

The unit comes with an 8-foot electrical cord and 12 feet of rubber hose. Also included are air chucks for Schrader fittings and blow valves. You can obtain the Speedy Auto-Flator for \$27.95 at most parts stores or from the W.R. Brown Corp., 2701 North Normandy Ave., Chicago, Ill. 60635.—*M.L.*

3-M 4-Way Lubricant

If you want to keep something dry but lubricated (like door locks, distributor caps, moving parts in projectors, and the like), this might be your answer.

Its name, 4-Way, is intended to mean that it penetrates, lubricates, dries and protects. Its low surface tension lets it wedge its way under



water and high-surface-tension liquids, so that it actually displaces moisture. Since it stays on surfaces and in cracks, moisture can't return to cause rust or corrosion. 4-Way can be used on metal, plastic, rubber, fabrics and all types of paints. Price of the 24-ounce pressure can (which comes with pinpoint nozzle) is \$4.25.—*M.L.*

Supershine

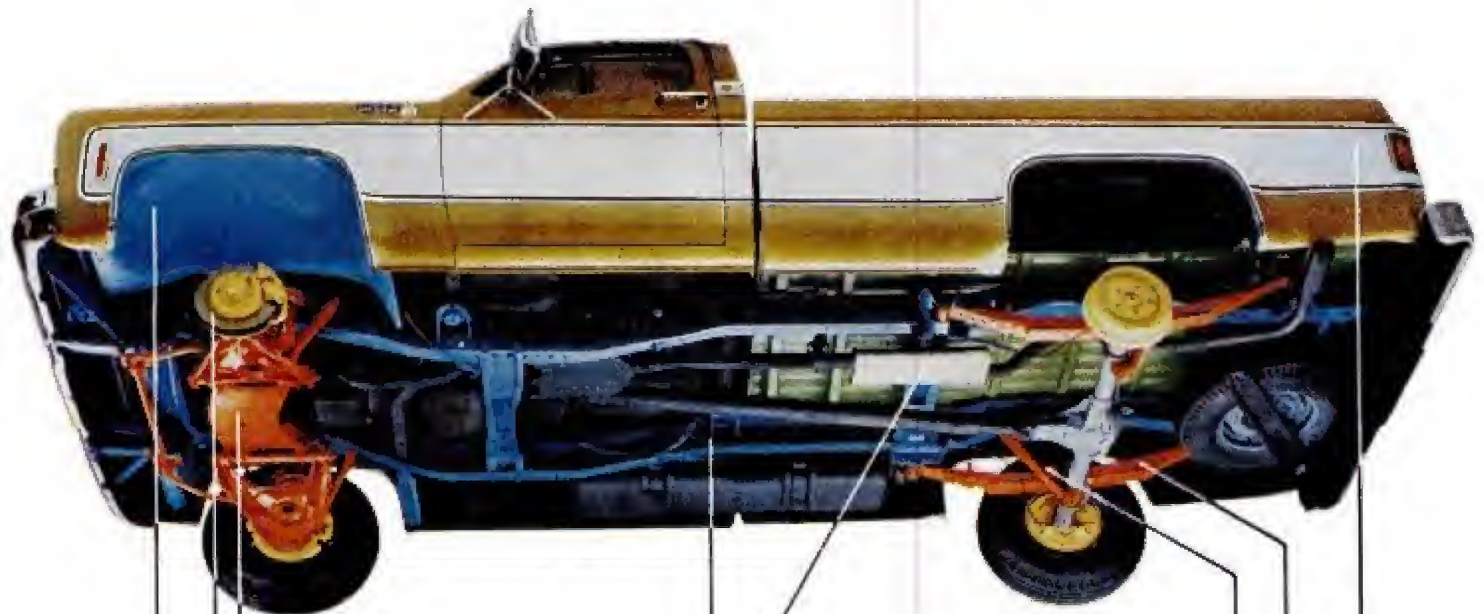
There's a new wax on the market that's guaranteed to shine longer and last longer (or your money will be refunded). Since it's supposed to keep water beading on the surface



rain after rain, the maker named it Rain Dance. It's a cute name for a liquid wax that I found goes on easily, has excellent cleaning power and really does give a super shine.

By the way, when you shop for wax, be sharp: My can of Rain Dance was \$4 at a big chain store; at my local auto supply store, it was tagged at \$5. Du Pont Co., Wilmington, Del. 19898 is the manufacturer.—*B.H.*

A road's-eye view of Chevy truck toughness.



Massive Girder Beam

independent front suspension uses steel control arms, friction-free coil springs. Wheels step over rough spots individually, helping smooth the ride.

Computer-matched brake systems have fade-resistant front disc brakes, fin-cooled rear drum brakes and power assist (most models) tailored to the truck's GVW rating.

Full front wheelhousings help protect fenders and engine compartment from road spray and rocks. All-steel, one-piece inner and outer fender panels form a double wall for structural rigidity.

Ladder-type steel frame uses deep-section channel side rails, riveted crossmembers for strength, rigidity and durability.

Aluminized muffler uses heavy-gauge metal for shell and baffles. Aluminum coating inside and out adds corrosion protection.

Counter-angled rear shock absorbers are slanted, one forward and one aft, to help keep rear wheels firmly in contact with the pavement during acceleration and deceleration with heavy loads.

Multi-leaf rear springs provide a good ride with light loads, progressively firmer support as cargo weight increases.

Double-wall construction adds strength and durability in many important areas. Fleetside body side panels, doors, upper cab panels, windshield pillars, roof, cowl and hood.



YOUR MONEY'S WORTH. MILE AFTER MILE AFTER MILE.

Give me one good reason why I should learn electronics.



Learning about electronics can be fascinating!

Learning electronics isn't some big mystery. We're not saying that it's easy, but here at Bell & Howell Schools we believe that if you start at the beginning and work your way logically through a problem, you'll find electronics interesting... fascinating... and understandable.

You see, you don't have to learn electronics just by plowing through an endless string of books and exercises—that would bore anyone, especially a guy who likes to work with his hands.

At Bell & Howell Schools we believe that the way to learn about electronics is to actually work with state-of-the-art electronic equipment. And what better way to find out how things fit together... how they work and why... than to actually build the equipment as you learn.

Well, that's exactly what you'll do as a Bell & Howell Schools' student when you build your own Electro-Lab® electronics training system. It's up-to-the-minute professional equipment that you can actually use later professionally.

You'll use our design console to set up and examine circuits without soldering.

You'll use our digital multimeter to measure voltage, current and resistance. Big, clear numbers are easy to read.

You'll use our solid-state "triggered sweep" oscilloscope to monitor and analyze integrated circuits. "Triggered sweep" locks in signals for easier observation.

After you've completed your Electro-Lab® electronics training system, you'll actually use it to gain "hands on" experience as you build a new generation 25" diagonal color TV with digital features. Here's where you'll see all the electronics principles that you've been reading about in action. Sounds exciting, doesn't it?

Well, it is. As Lawrence E. Colson, one of our recent graduates, put it, "... I was so interested that when I received a shipment, I could hardly wait to get it completed." We think that you'll feel the same way!

The skills you develop could open up exciting new directions for you in the world of electronics.

And isn't broadening your horizons what education is supposed to be all about? At Bell & Howell Schools we've always thought so.

Just take a look around you. So many things today seem to be going electronic. The new digital calculators and clocks... electronic watches... even the new stereos and TV's are depending more heavily on new electronics technology.

But how many people actually understand how these things work? Well, now you can. With Bell & Howell Schools' Home Entertainment Electronics Course, you can learn how to "trouble shoot" many electronic equipment problems. And as you learn more and more you'll come to understand today's highly sophisticated electronics technology. Plus, you'll actually know how and why things run—and if they break down how to repair them.

We're not saying that we'll guarantee you a job or income opportunity. No school can guarantee you that. But the skills you learn from this Bell & Howell Schools' program could help you look for a job in the electronics industry... or upgrade your present job... or be a practical base for continuing your education in electronics programs.

And remember, when this course is taken for vocational purposes, this program is approved by the state approval agency for Veterans' Benefits.



Electronics is a field that you can explore without ever attending a class or missing a single day's work.

Imagine the pleasure of discovering the fascinating world of electronics right in your own home. To be able to work on your projects when you like. At Bell & Howell Schools, you choose the time and place to study.

But just because you're learning at home doesn't mean you are on your own. Bell & Howell Schools has introduced a system of personal contact with our faculty and students that combines the freedom and convenience of home study with plenty of personal attention.

For problems that can't wait, you just dial our toll-free "hotline." A courteous, knowledgeable instructor will get you answers — and get them fast. At our "In-Person Help Sessions," held in over 50 cities at various times throughout the year, you can get together to discuss your ideas and problems with faculty and other students who share your interests. At Bell & Howell Schools we believe in giving our students the individual time and attention they need.

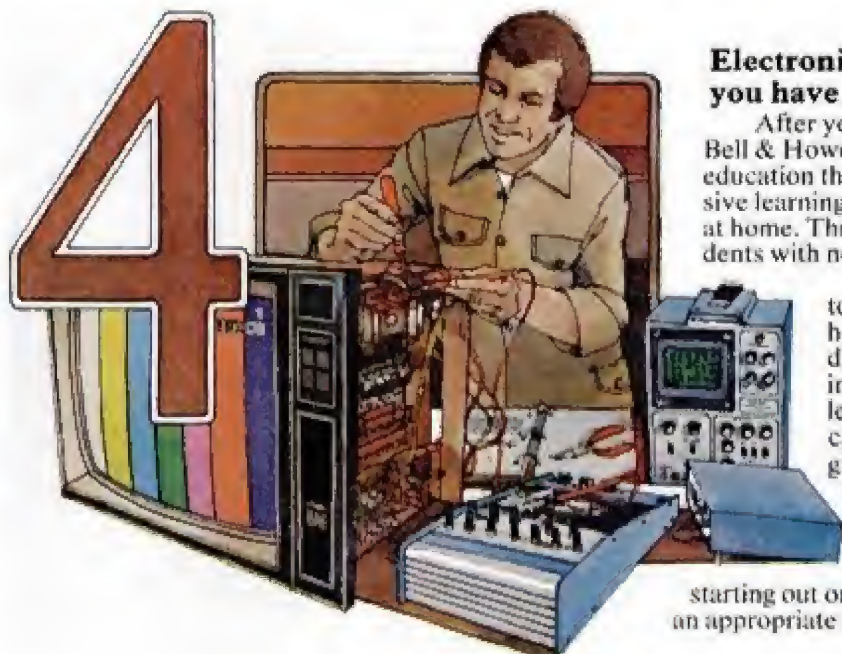


Electronics is a field that you can learn ... even if you have no prior experience or training.

After years of experience in the home study electronics field, Bell & Howell Schools has developed a step-by-step philosophy of education that provides our students with a vital and comprehensive learning system ... specially designed for studying electronics at home. Through this method, we have actually graduated students with no prior electronics experience.

No subject is going to be interesting and enjoyable to learn if you're having trouble understanding it. So to help you master electronics, Bell & Howell Schools divides its Home Entertainment Electronics Course into digestible bite-sized chunks. This enables you to learn electronics one principle at a time — moving logically, step by step, from problem to solution. You progress at a reasonable pace, and move on to new concepts only after you've mastered the previous ones.

At Bell & Howell Schools, we realize that we are dealing with students with various levels of knowledge in electronics. So whether you're just starting out or have several years of experience, we place you at an appropriate level.



You'll feel a great sense of satisfaction over your educational achievement.

Many of our graduates have been extremely happy with the outcome of their Bell & Howell Schools' course in Home Entertainment Electronics. The majority of our graduates feel that they have realized one or more "career advancement benefits" as a result of the course. (Based on a recent survey of our graduates conducted by an independent research firm. Survey results available on request.) We believe that you'll feel the same way.

And remember, at Bell & Howell Schools you learn ... build ... grow without really upsetting your everyday routine. As Stephen R. Gaumer, a 1974 graduate, stated, "... The lab assignments enabled me to get practical experience that I couldn't get from books alone. This course helped me to further my education without changing my lifestyle."

Well, now you have five good reasons why you should develop electronic skills. But there's more. Find out more about Bell & Howell Schools and our courses. Mail the postage-paid card today!



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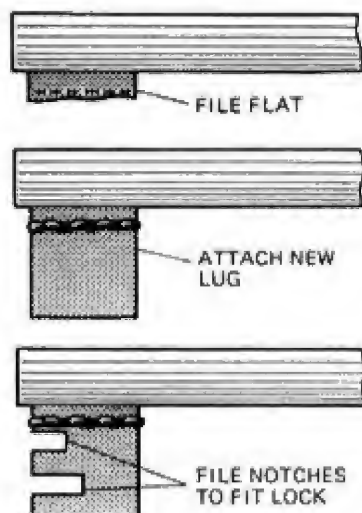
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HOMEOWNERS' CLINIC

Desk key repair

I have an old desk with locks on all the drawers, and the wing or lug on the only key I have is broken off and has been lost. Can I repair the key, or must I make do without?—J. Satterwhite, Lexington, Ky.



I once made such a repair, beginning by removing the lock and prying off one of the plates, which was held in place by bent-over metal ears or tabs. On some old desk locks the plates are held by a rivet and you may have to file the rivet head down to remove the plate. Once the plate is off, you have a clear view of the mechanism and from this you can determine the fit of the replacement lug.

Cut a new lug from brass and solder or braze it in place. Then place the key on the guide and mark the locations of the necessary notches, usually on the front edge of the lug. Only repeated trial and filing will determine the required widths and depths of the notches to operate the lock freely.

Window removal

I have a picture window consisting of a large, fixed center sash with double-hung sash at each side. There are three panes in the big center sash and one is cracked. In order to replace the cracked pane handily I need to remove the center sash. But how do I get it out of the frame?—J. Roth, Princeton, N.J.

I must make these two assumptions based on your description: that

the framed sash are an older type, and that the panes in the center sash are not double.

If you remove the inner stops you can usually lift the center fixed sash sufficiently to permit the lower rail to clear the stool (this part is often mislabeled the "sill"). But such older units probably have been painted at least twice, which means that both the stops and the sash must be removed with extreme care or you will damage them.

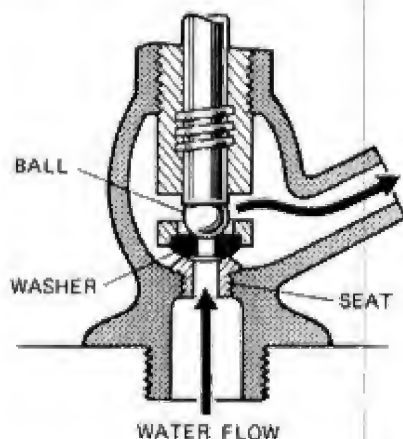
Loosen the stops by forcing a putty-knife blade inward along the edges to break the paint film. Do the same along the stool until the sash rail breaks free. Then you should be able to lift the sash out of the frame quite easily.

What kind of faucet?

Recently I took apart a leaking faucet, thinking that it needed a new washer. A ball about 1/2 in. in diameter dropped out of it along with the washer, which was in pieces. Now I'm at a loss to know how to reassemble the parts. What goes where and what kind of faucet do I have?—A. Ashley, Salem, Ore.

According to your description you have a type of compression faucet. The ball, seated loosely at the bottom end of the stem, bears against the washer as shown in the illustration below.

The purpose of the ball is to effect a tight closure without turning the



washer against a fixed seat. Replace the washer and parts as shown. While you have the faucet apart, it's a good idea to replace the packing to prevent possible leakage at the stem.

'Tin-can' septic field

What's your opinion of my idea of using crushed aluminum cans to form a drainage or effluent field for a septic tank? Or do I hear you laughing?—R. H. Friedlund, Hanover Mich.

No, you don't hear me laughing! Good or bad, a new idea is refreshing. But by the time the idea is assimilated, the questions intrude: Do you need such a system in the almost universal sandy soils of your state? How do you propose to crush the cans—and into what shape or shapes? What happens to the crushed cans after they are buried in the field? Will they settle appreciably in time, requiring fill? Will your local or state health authorities approve such change from current practice?

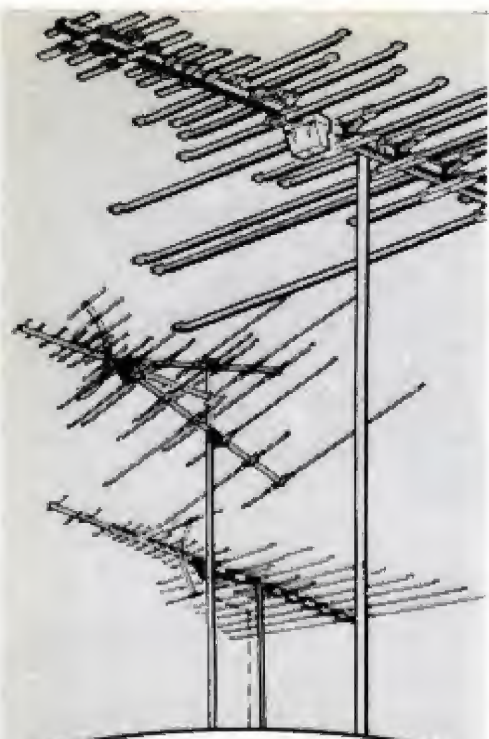
I don't have the answers, but you should try to get them before beginning such a project. Also, it should be pointed out that aluminum cans have recycling value, which you will negate if you bury them.

Planning savings

If you have any questions about what energy-saving home improvements can mean to you in dollars and cents, a good source of answers is *In the Bank... or Up the Chimney?*, a new, 72-page book published by the Department of Housing and Urban Development. It gives clear, detailed instructions on insulation, storm windows and weatherstripping—and lets you know which improvements *won't* make sense in money terms for your house.

The book can be used anywhere in the Continental United States (including Alaska). Order it as stock No. 2300-00297 from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Make out your check or money order for \$1.70 payable to Superintendent of Documents and allow five weeks for delivery. ★ ★ ★

Do you have a home maintenance or repair problem? Send it to Homeowners Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.49 postpaid. Send orders to PM, Dept. HK5, Box 1014, New York, N.Y. 10019.



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If you are not getting the color quality and picture clarity you expect from your TV set, it's very possible your present antenna is old, worn, or damaged. You may not be getting all the stations you should be. And "Ghosts" may be appearing in your picture because of new tall buildings.

For all of these problems, there is a solution. Winegard makes the most powerful and most sensitive antennas available, in a range of anodized aluminum models that meet the specific needs in every area.

So, if you haven't been getting the best possible TV picture, get the best antenna. See your Winegard TV antenna dealer soon. Or write to Winegard for a free booklet with answers to your questions about TV reception. Dept. M



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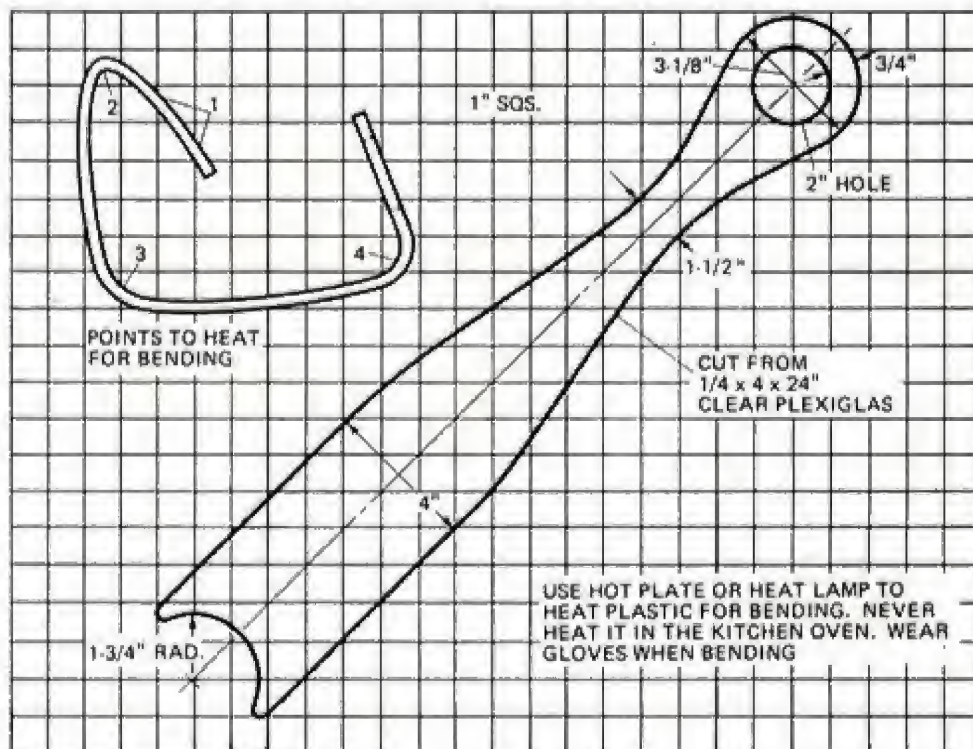
THE TV ANTENNAS MORE PEOPLE LOOK UP TO

QUICK SHOP PROJECT

Wine server



Pouring wine from a bottle held in this smart clear-plastic holder adds a graceful touch to party entertaining.



Resting in this handsome holder, a bottle of wine is not only easier to pour but takes on an elegant look when you're serving guests.

Use a jigsaw, sabre saw or bandsaw to cut the Plexiglas to shape and a 2-in. hole saw for the hole. Remove the saw marks by scraping with a sharp chisel or knife, then hand-sand with fine sandpaper and polish glass-smooth with a cloth buffing wheel

charged with polishing compound. The three bends are made by holding the plastic over a hot plate or a 250-w. heat lamp. Hold the plastic a few inches from the heater for about 10 minutes until it becomes soft, and wear gloves so you can handle the hot material. There is always some spring-back so overbend slightly. *Never heat acrylic plastic in a kitchen oven.*—Rosario Capotosto

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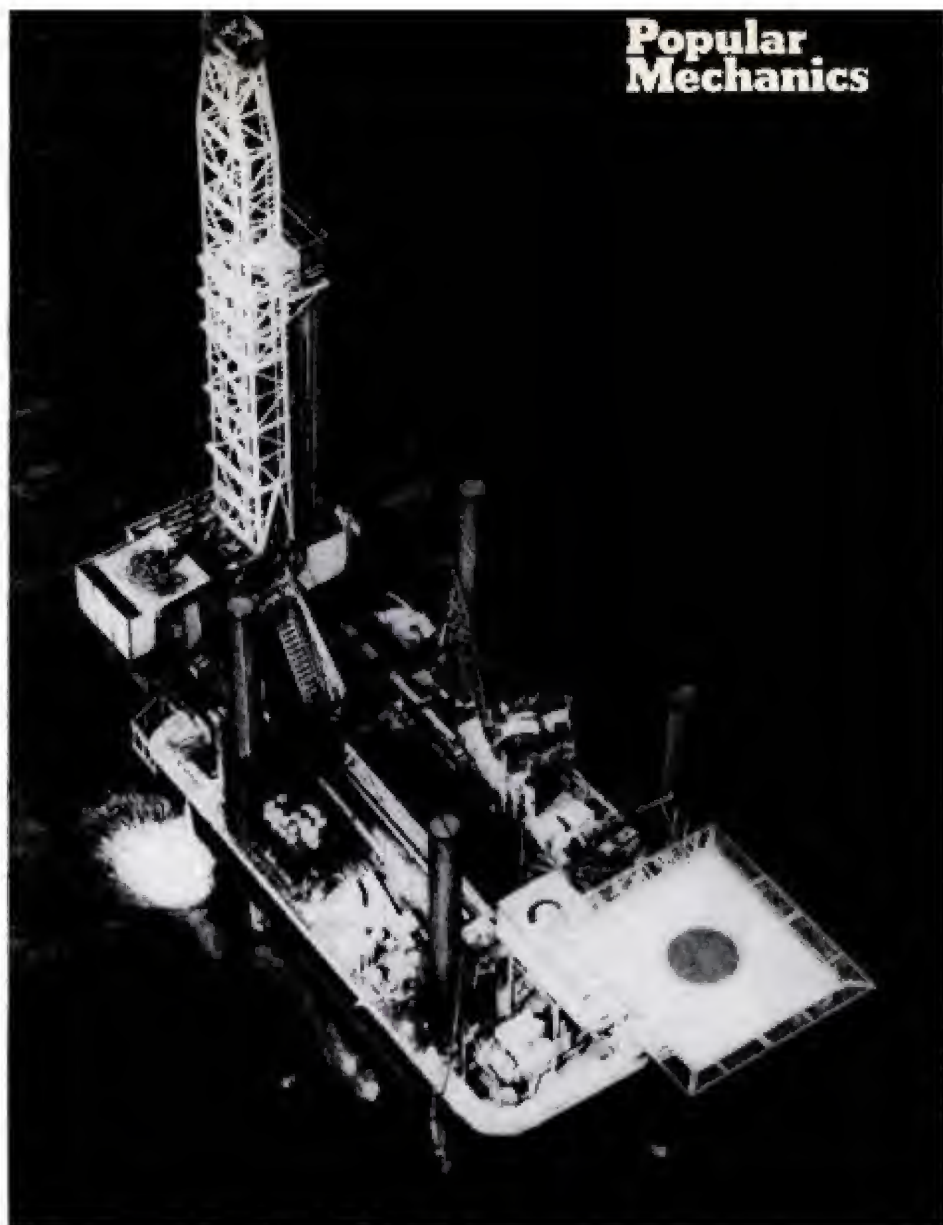
Filter King: 18 mg. "tar", 1.2 mg. nicotine, av. per cigarette, by FTC Method.

Dark as a tomb. Water neck high. A bubble of fetid air to sustain them. This was the ordeal of five men. . .

Trapped in a sunken oil rig



Photo: U.S. Coast Guard



Without warning, the *Progress Marine II* capsized, leaving only part of pontoon above water (photo at left). Jack-up rig shown above is identical to the ill-fated drilling rig.

by Mary Kell

Early on the afternoon of Sunday, June 1, 1975, the tug *Admiral Lee* was towing a jack-up rig, *Progress Marine II*, to a new worksite in the Gulf of Mexico. It was a typically slow trip, for the derrick-topped rig tended to be awkward in the water. But there appeared to be no problems. The weather was ideal: a clean sky, only slight seas and almost no wind.

A crew of only 12 men—about one-third the normal complement—was aboard. There were two messmen, several deckhands, the toolpusher and the rig's captain. Some crewmen were resting in their bunks in the living quarters below deck. Others were topside, lazing in the sun.

The rig was about 18 miles southwest of Grand Isle, La., when it sud-

denly began to list to starboard. Within seconds it was apparent that the top-heavy structure would not recover, but would capsize.

Derrell John Dore, one of the men on deck, raced below to warn the sleeping crewmen. "I saw them in the hallway," he reported later. "We were all running—on a wall, not the deck! I ran into a room and then the water came against the door."

Joseph Bellard woke up in his bunk and had to struggle to get out of it as the room tilted. He headed for the deck hatch but was forced back by a wall of water.

Steve George felt a "funny shaking" of the rig as he lay in his bunk. "I thought it all was a bad dream. I got up to see what was going on and then—all of a sudden—there she was, rolling over."

The men who had remained on deck were thrown into the sea . . .

A jack-up rig like the *Progress Marine II* is one in the mélange of

specialized equipment developed to meet the needs of the offshore-oil industry. It's ideally suited to the relatively shallow depths of the Gulf.

This type of rig is basically a barge equipped with three or more vertically adjustable legs. On site, the legs are lowered until firmly planted in the ocean bottom, and the barge or hull is jacked up to about 30 feet above the water to provide a stable work platform. The hull of the *Progress Marine II* is 96 feet long, 50 wide and 10 deep. Its four adjustable legs are each 122 feet in length, permitting the rig to work in water as deep as 70 feet.

Like the *Progress Marine II*, some jack-ups have legs connected to a large pontoon—sometimes called a mat—that can be ballasted. The mat provides a broad area of contact with the seabottom, increasing the rig's stability. The *Progress Marine II*'s mat is 82 by 78 feet and 4 feet deep.

When the rig is to be moved, the

Author Mary Kell, former editor of *Undercurrents*, a magazine for commercial divers, specializes in reporting developments in the offshore-oil field.

legs are raised, pulling the mat close to the bottom of the barge's hull. But the raised legs plus the tall derrick tend to make the barge top-heavy when under tow.

At the time of the accident, the *Progress Marine II* was being used for maintenance and repair work on producing oil and gas wells. The rig was in about 40 feet of water when it turned over and came to rest at a

110° angle. The tops of two of its jacked-up legs hit bottom, becoming embedded in muck. Only part of the mat broke water.

It's estimated that it took 60 seconds for the rig to capsize. As it was going over, Bobby Coker, a repairman on a Shell Oil Co. platform about 600 yards away, yelled to Jim Arnett, the platform clerk. Arnett came on the run. "The rig was al-

most submerged," he said later. "A big cloud of smoke went up when the engines went under."

Arnett sent a Mayday to the Coast Guard station in Grand Isle and alerted officials at the Progress Marine office in Morgan City, La. The skipper of the platform utility boat cast off immediately and a helicopter, which had been sitting on the platform's pad, took to the air.



Six of the rig's crew were floating in life preservers near the wreck. With the copter pilot serving as spotter, the utility boat pulled four to safety. The other two were rescued by the skipper of the *Admiral Lee*.

The six other crewmen were presumed trapped in the hull of the rig.

Cmdr. Ron Stenzel, chief of the Coast Guard search and rescue center

in New Orleans, ordered several cutters to the scene. Soon after the first distress call, a Coast Guard helicopter was airborne with a team of divers from Global Divers and Contracting, Inc., Harvey, La.

Sam Toga, a Continental Oil Co. dispatcher in Grand Isle, knew the tug *Jean G* had a diving crew aboard and was in the vicinity. He called the tug to proceed to the capsized rig.

Toga would remain on duty night and day, coordinating communications, relaying progress reports and requests for men and equipment.

Officials at Progress Marine, Inc. had the barge *Sal Duoy* moved to the site and requested additional divers from Ocean Systems, Inc. and Continental Diving.

The *Jean G* arrived about 5:00 p.m., two and a half hours after the rig turned turtle. Global divers in the Coast Guard helicopter landed 15 minutes later.

Chuck Mowry, a lean, bearded man, had been designated diving supervisor and coordinator. Seconds after stepping out of the helicopter, he huddled with Progress Marine officials and rig toolpusher Paul Reed, who advised on the probable location of submerged rig equipment and made sketches of the interior layout.

A companionway ran down the center of the hull, connecting the galley in the bow and the engine room in the stern. Sleeping quarters were amidships, four separate rooms, two on each side of the companionway.

"First we climbed out on the hull of the rig and tapped in various places," Mowry later explained. "The rig was making a lot of noise—creaking and groaning as it wallowed—and we didn't hear any response from inside. Then we made several survey dives.

"The water around and under the rig was a mess with a jumble of pipe, catwalks, steel walkways, tangled lines and hanging crane rigging and masses of other loose rubbish."

The debris constituted a real hazard to divers dependent on surface-supplied air through hoses that snaked and looped behind them.

"We finally decided to try to enter a hatch near the bow by the galley where there wasn't as much junk in the water," Mowry said. He headed the first team of divers.

Tugging and prying at the submerged hatch cover, they found it was jammed by the pressure of the sea and could not be opened in a normal fashion. With underwater burning gear, they cut the hinges of the hatch, pried it loose and entered the black swirl of the flooded galley.

Each diver carried a powerful underwater light but could see only

(Please turn to page 134)

Art: Herb Mott

Poor visibility hampered divers' rescue efforts. In galley (detail, near left), man lying on pipe startled diver by grabbing his arm. In engine room (detail, far left), four men desperately awaited help, were finally found by diver emerging from water into their fume-fouled air pocket.



Vans have got a lot more going!

For rolling sports shelter, surfer chalet or party pad, these turned-on trucks offer you on-the-go fun.

by Bob Behme

What has four wheels, an outside paint job that often looks like a psychedelic sunrise, interior decor that can resemble a plush padded cell, and is becoming a way of life for a lot of young peripatetic people?

If you've been out on the highway recently, the easy answer of course is custom vans. They are the only RVs selling well in today's slowed-down automotive economy, and now the rigs are making a successful transition across age and culture barriers. Whole families are finding out about these far-out versatile vehicles that have been giving the kids their kicks.

The idea began in 1969 when spartan panel delivery trucks and utility vans began to be customized by the 17-to-25 generation. Converted into portable pads, the vehicles reflected the individuality of the owners and were tagged with the title: "Sin Bins." As one young driver explained, "Vans were essential. Take a girl out in a car, park, and in five minutes

every cop in town was shining a flashlight in your face. With a van you had a little privacy."

In the years since, vans have changed. Though still built from windowless utility rigs, they've become a whole new type of recreational vehicle that offers luxury living at relatively low cost. They've become more respectable and law-abiding, too—you don't have to be a wandering single to enjoy the benefits of traveling in style in a rig customized to suit your own particular needs and tastes. Today's models are for all generations—for family outings, hunters, campers, skiers, fishermen—anyone who likes the outdoors with a touch of class indoors.

Converted vans make good economic sense, too. While most lack the cooking, dining and storage facilities of larger, more lavish motor homes and campers, they're still suitable for weekend living—at a fraction of the cost. They also deliver surprisingly good gas mileage, making them economical to operate.

You can do your customizing yourself or have it done by a specialist. For around \$400 to \$700, you can install many of the luxury features a professional customizer would provide. Or you can go all the way with a commercial custom job and spend \$3000 or so. Either way, you'll wind up with a unique, fun-packed, luxury RV for what is still a remarkably low price.

Like the custom cars of the '50s, the first van conversions were hand-built, but now a number of firms mass-produce them. Among these are big conversion companies like Hop Cap, Sportsmobile and Gerring in Indiana, Red-E-Camp and Bizi-Bodi in California and LPR in Wisconsin. Van specialists are spreading, and the local directories in almost any city will now list one or more. You can choose between plush carpeting and artificial fur for the floor, walls and ceiling, and add roll-away or water beds, custom lounges, eight-track stereo, built-in bars and special

(Please turn to page 160)



Dodge Tradesman (left) gets torrid look once conversion specialists paint on favored geometric forms and flames.

New Ford Econoline (right), called a "third generation" model by maker, is suitable also for in-and-out styling.

Chevyvan (below) converted by Bizi-Bodi, van specialists of San Jose, Calif., to match decor of a ski-boat.



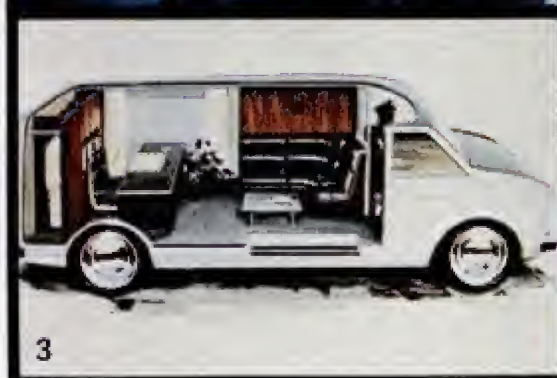
1. Ford designers created these van conversion suggestions. Beach buggy has tank racks, bunks for scuba divers, rack for surfboards.

2. Winter sportsmen can park at ski slope and warm up between walls in lift line in this Econoline van conversion with galley, bunks.

3. Formal office setup far from the far-out party-pad decor, puts desk, clothes and supply closet, bar and conference table in back.

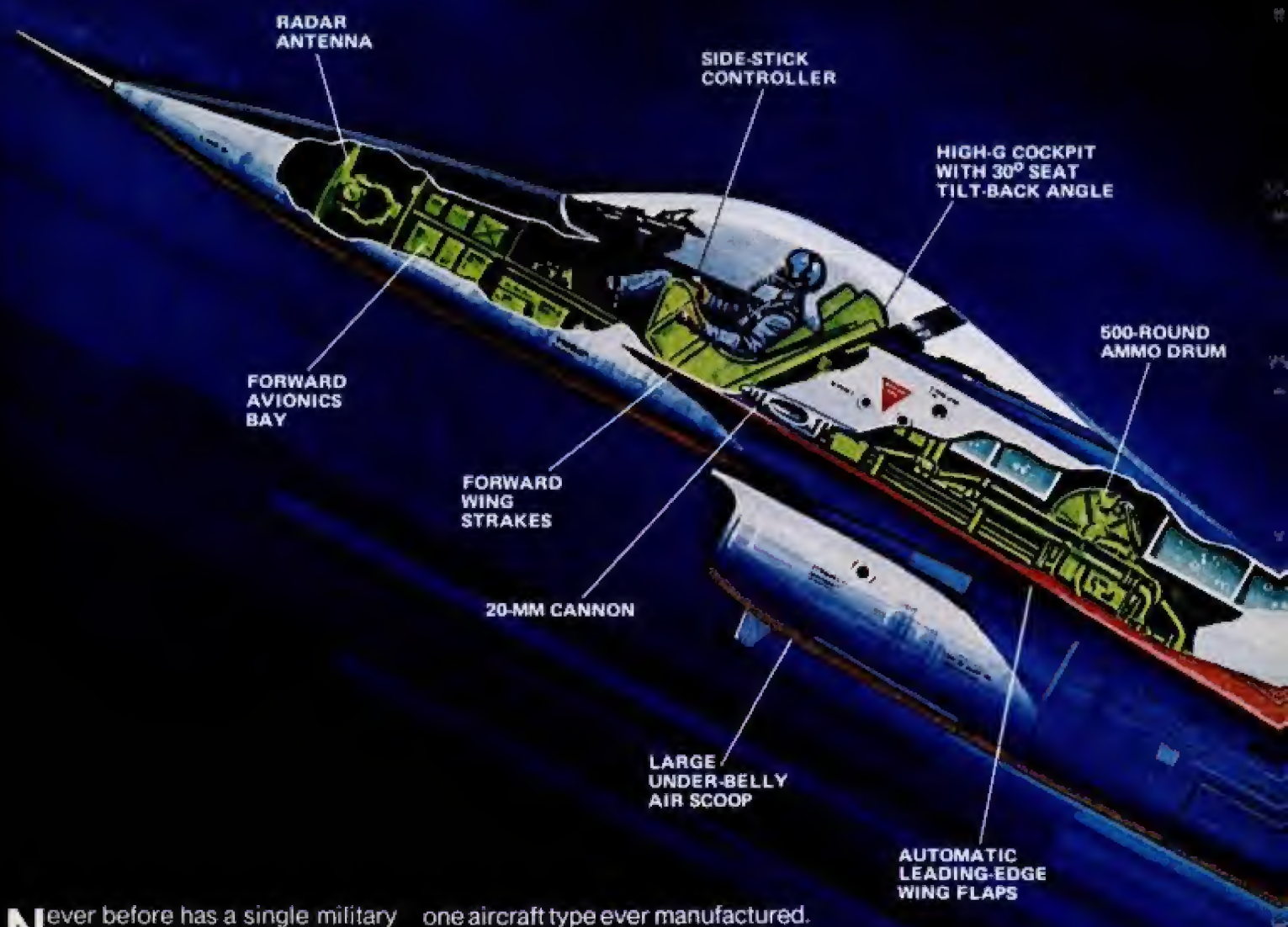
4. Trail action is aided with drop-ramp tailgate for bicycles, trail bikes, karts or snowmobiles. Track, trail supplies, bunks are carried.

5. Sportsmen especially can use camping vans at right and below. Headroom is low, but hunting group or full family fit in for sleeping.



Camper van, with add-on cabana-tent, stretches accommodations and range for on and off seasons.





Never before has a single military aircraft excited so much interest the world over. It's the F-16, newest, hottest addition to U.S. air might and a plane that may well become the most sought after of all time. Scarcely off the drawing board, the fighter has not only been adopted by our own Air Force, but has become the popular choice of four other NATO nations, beating out such stiff competition as the famous French Mirage and the radically new canard-winged Swedish Viggen.

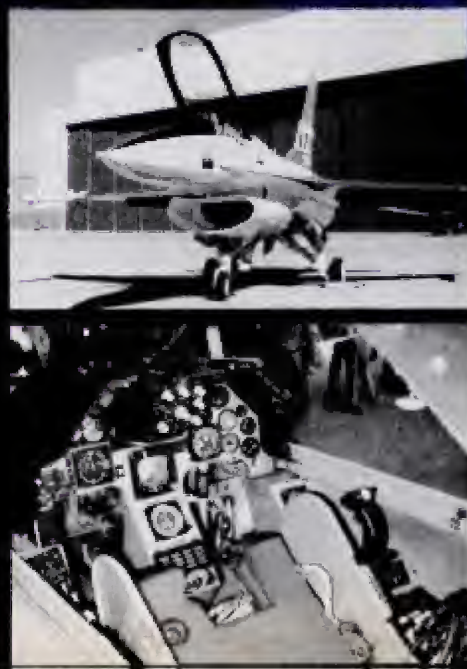
Belgium, Norway, Denmark and the Netherlands have jointly signed up to purchase 350 of the sleek, multi-role supersonic jets, and other countries, including Canada, may follow suit. The U.S. Air Force has ordered 650, and the Navy is expected to buy 800 more for carrier use, bringing the initial total to 1800. With anticipated additional purchases, production runs may eventually go as high as 3000 to 4000—possibly the greatest number of any

one aircraft type ever manufactured.

What accounts for the F-16's incredible appeal? It's not the biggest, not the fastest, not the most powerful. In fact, by modern fighter standards, it's a relative baby. Developed by General Dynamics, the single-engine single-seater represents a new concept in low-cost, high-performance lightweight fighters, designed to provide both air superiority and economy at the same time. It's fast, tough, deadly and versatile—all for what is considered the remarkable price of \$4.6 million per plane. That may not sound "cheap" to those of us who cringe at a \$50 grocery bill, but in the world of military hardware it's a bargain—other comparable fighters go for \$8 to \$12 million apiece.

With an overall length of 47½ feet and a wingspan of 31, the F-16 is considerably smaller than earlier fighters like the F-14 Grumman Tomcat (62 by 64 feet) and the F-15 McDonnell Douglas Eagle (64 by 43

Needle-nosed F-16 is small, light, highly maneuverable fighter capable of Mach 2 speeds (twice the speed of sound). Below, note side-stick control handle on right and sharply back-tilted seat to help the pilot withstand high G forces in combat.



(Please turn to page 124)

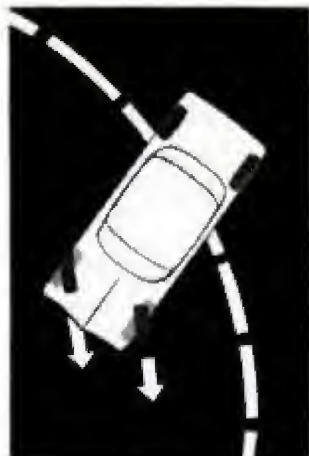
by Sheldon M. Gallager
EXECUTIVE EDITOR



Art: Ed Valigursky
Photos: Howard Levy

10 tips to keep you on the road this winter

by Michael Lamm
WEST COAST EDITOR



1 When you feel your car start to skid, let up on the gas at once and steer into the skid. Actually, you will automatically steer into any skid, because that's the way you wanted to go in the first place. Do *not* hit brakes. Instead, tap them lightly in short bursts.



Minimize dangers of winter driving by preconditioning your reflexes. Read these tips, and practice before you need to use them. Carry what you'll need: chains, sand, short shovel, blankets, ice scraper, flares, matches, even food. Drive with headlights on, but be sure to turn them off when you park. Concentration, caution and low speeds are your best friends on slippery roads. Remember to buckle up snugly so you stay in place during unexpected maneuvers.

2 If you're stuck in snow, shovel paths ahead of and behind each tire. Be sure your wheels are pointed straight ahead. Rock car gently; spread sand for added traction.



3 Different chains go on in different ways, but most commonly you lay them out behind wheels with hooks on inside, spring clamp holding end to rim. Bunch up chain, drive forward. Rubber bands hold chains tight; stop flapping.



4 Good vision is key to safe winter driving; be sure both sides of windshield and all other windows are clear. Dust or scrape off headlights and taillamps, too.



Art: Harry Bergman



6 200 pounds of sandbags in your trunk helps traction. Sand also comes in handy to sprinkle on icy surfaces and to increase tire traction.



5 When rocking car, shift smoothly between reverse and drive. Try not to make tires spin and let transmission cool every five minutes.



7 Hard braking can lock wheels on ice; tires that slide have no traction. Pump brakes at one-second intervals if you feel your tires locking up.

IF YOU'RE . . .

8 Stuck in a blizzard, leave your car only if you know you can reach safety. Otherwise stay with it. Wrap up in blankets, newspapers, floor mats, whatever. Fast-idle the engine at intervals to heat the heater, but don't waste gasoline or the battery.

9 Locked out because the door locks are frozen, unfreeze them by heating your key with a cigaret lighter or match. You might also try pouring hot water over locks. You can prevent frozen locks by lubricating them with powdered graphite.

10 Suddenly driving on glare ice, slow down either by tapping brakes or simply by coasting. If you're trying to get rolling, accelerate very gently. Test slipperiness by jabbing brakes or accelerator, depending on speed.

Simple cameras can take good pictures—if you let them

by Ivan Berger
PHOTOGRAPHY EDITOR

Think you need a fancy camera to get good shots? You don't.

But what you do need is a mind that's alive to what makes good pictures and that flashes a warning signal when you're about to take a bad one.

A \$400 camera doesn't make you a good photographer. It just lets you shoot equally good (or equally bad) photos under a wider range of picture situations. And all



Panning camera with action simplifies the background by blurring it—and keeps the moving subject sharp, even on simple cameras without fast shutter speeds.



Background and foreground are equally sharp with most simple cameras: So pick clean, interesting backgrounds that make this sharpness pay off for you.



Always ready, simple cameras make it easy for you to get quick shots like this—if you can keep yourself ready to see and shoot them.



Window light, soft but directional, is great for portraits.

Backlighting illuminates faces softly, puts highlights in hair, lets subjects keep eyes open without squinting into sun.



Photo: Rhoda Berger



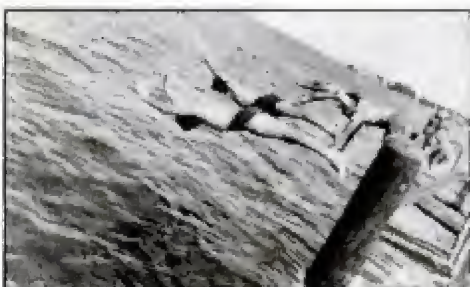
Cameras that focus can simplify complex backgrounds by blurring them.



Good snapshot isolates its subjects against non-distracting background, shows people living — not just posing.



Common goofs abound in the top photo: The foreground is nice and sharp, but there's a lot too much of it, and the background where the interest is is far away and fuzzy. Moral was to move in close, check focus. But close-ups have their own problems (above center): Arms and legs swell to elephantine size if they project toward the camera. Harsh shadows on face, eyes squinting into sun, horizon through head also disfigure this shot. Third try (bottom photo above) has higher angle to isolate subject on plain background, better pose to keep subject's proportions correct, better light on face, fewer shadows.



Tilted horizons are a common fault: Hold your camera level at all times.

the good techniques and horrible-example pitfalls shown here apply just as much to Nikons as to Instamatics.

With three exceptions, these photos weren't taken for this article—I dug them up from my own personal and family photo archives. Among the cameras used were a \$30 35-mm camera from a firm you never heard of, a Kodak Pocket Instamatic, a \$30 Polaroid Super-Shooter, a folding Kodak from the early Thirties and an old, used Rolleicord. Can you tell which camera shot which?

Not every photo goof found room in our picture layout. Here are some favorites we had to leave out:

Bad backgrounds. These range from the merely distracting (a room full of furniture, a horizon full of telephone lines) to the classic telephone pole or tree growing out of someone's head. These problems are usually visible in the viewfinder—but you must remember to look for them. Move around, move your subject if necessary (and if possible), until you get a plain background.

Bad shadows. Shoot with the sun over your shoulder, as so many photo books have recommended, and you not only get subjects squinting at the sun, you may get your own shadow in the picture. Watch also for shadows falling on your subjects' faces (twigs and leaves cast especially distracting ones).

Obstructed lens. Be careful your fingers aren't in front of the lens when you shoot; and keep your lens clean with soft lens tissue, for sharper images.

Bad flash. Read the instructions and find out the range your flash is good for. Try to shoot flash at 50 feet, and you'll just get darkness, while flash from too close can wash out details. If you must flash when a window or mirror is in your field of view, stand at an angle so the glass won't reflect light back in your lens.

Think. The best good-picture accessory is your brain—which you can use with any camera. ★★



Empty foregrounds (top) are sometimes easy to fill; I waited for the other ferry, then maneuvered to get fellow tourists in shot. (New Yorkers will spot this as old shot: no 110-story World Trade Center).



Cut-off heads in close-ups are due to different views seen by camera's lens and viewfinder. Difference is negligible with distant subjects (above), but big when subjects are nearby. Viewfinder frames in all but simplest non-reflex cameras (right) show what will be cut off at close distances.



Photo: Leonard Berger

IT'S NEW NOW

New model planes

Model planes are turning up in interesting new shapes. The rubber-band-powered craft at near right has a pusher prop and unusual large rear wing, claimed to provide greater stability. Springy foam wheels soften landings, and wings and tail pop off undamaged in a crash. Skywinder, with geared crank to speed winding, \$4.95. Amsco Industries, Springfield, Mass. 01101. At far right is a fuel-powered, control-line autogyro with a 17-inch rotor that actually autorotates to provide lift and gentle power-off landings when fuel is exhausted. Kit is \$9.95 postpaid or \$16.95 with engine. Kopter Kit Co., Box 607, Saddle Brook, N.J. 07662.



This flying saucer is no mirage

Half airplane, half airship, this saucer-shaped Sky Ship may become the world's largest air cargo carrier. The 30-foot-diameter craft, under development in England, is a test prototype of a much bigger version that will be 700 feet in diameter and able to transport 400 tons. It uses turboprop engines for thrust, but incorporates helium air bags for added lift and increased payload.



Electronic checkbook

This pocket-sized electronic checkbook has built-in calculator for entering withdrawals and deposits and keeping a running balance. Memory keeps balance even when unit is shut off. Check-Master, \$39.95, Mostek Corp., 13300 Branch View Lane, Dallas, Tex. 75234.

Electric-three-wheeler hits 30 mph

This three-wheeler is electric-powered, eliminating fuel costs and pollution problems. The British-made Charger, said to be the first of its type in England, hits up to 30 mph, can be recharged overnight and costs only a few cents a week to operate. Price is about \$900.



Robot bomb detector rolls fearlessly to work

If you're afraid to approach your car because it might have a bomb in it, you send a robot instead—naturally. This mobile TV camera can be remotely controlled to peer into cars believed to contain bombs. It sends back pictures of what it sees to a TV monitor a safe distance away. The British Army uses it to check out suspicious vehicles, but doesn't say what happens if a bomb is hidden from view or doesn't look like a bomb—ouch!



Zero-in for hunting

For accuracy at the range or afield, these techniques put you on target.

by Tom Faulkner

No marksman, no matter how skillful, can hit anything consistently unless his gun shoots where he's aiming. The guarantee for a bull's-eye every time is top-grade equipment that is properly zeroed-in. This means gun sights that are adjusted correctly so you hit the target at which you're aiming. We all do miss at times, but the miss should be *your* fault—not the gun's.

The purpose of sights on rifles and handguns is well known to most shooters, but many do not realize it is possible and important to zero-in shotguns as well. First, however, let's check out a rifle with its basic sights.

Most rifles have open sights

Almost all rifles come with simple factory-installed sights, known commonly as "open sights." The adjustable rear sight consists of a piece of metal with a V or U-shaped notch cut in the middle of the upper edge. The front sight usually is a fixed blade or bead that is lined up in the rear sight notch. The process of placing the front sight on the target and simultaneously lining it up with the rear sight is called the "sight picture." Obtaining the correct sight picture and repeating it without variation for every shot is the key element of accurate shooting.

Two other types of sights are also used on rifles. One is the rear aperture or "peep" sight with a circular disc and a small hole in the middle. The shooter looks through the hole and places the top of the front sight blade or post in the middle of the circle. The third type is the telescopic sight which magnifies the target and

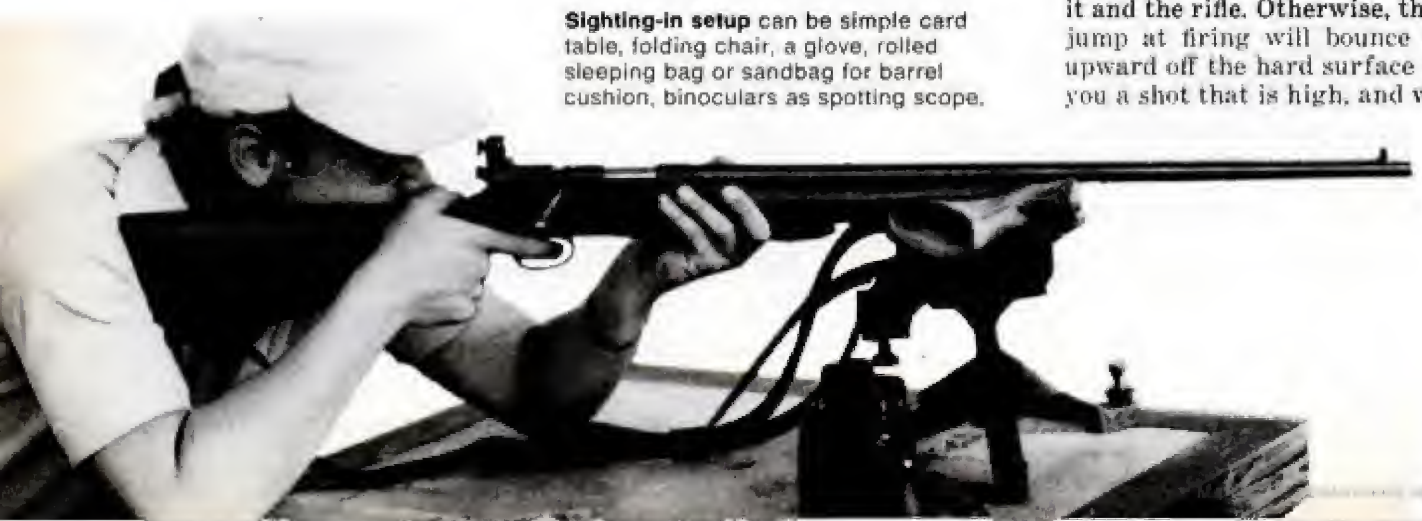
utilizes adjustable cross hairs, a single post, or a combination of both.

Theoretically, a perfectly sighted-in rifle, fired with a completely steady hold and a perfect sight picture, should put every bullet in exactly the same place. Actually, this doesn't quite happen, although it's possible to come very close. The limitations on perfect accuracy are the result of four variables. These include the limitations of your own eyesight in correctly lining up the sights on the target; the fineness of sight adjustments; the steadiness of your hold; and the inherent accuracy (or lack of it) of the rifle itself and the ammunition. All four limitations can be overcome somewhat. Peep and telescopic sights reduce eyesight limitations and permit finer adjustments. A steady rest helps. Highly sophisticated target rifles and custom ammunition are more accurate than standard rifles. But for normal hunting or plinking, any sporter rifle and standard ammunition made by reputable manufacturers have all the accuracy you will need.

You'll need a steady rest

Regardless of the type of rifle or sights you use, a steady rest is a must for zeroing-in. This should go under the fore-end of the rifle. Commercial rests can be purchased and are often available at club or public rifle ranges, but it's just as easy to improvise a rest out of an old pillow, a rolled up sleeping bag or several sand bags. The rest you choose should have flexibility to simulate the normal "give" of your hand when shooting without a rest. If you use a hard rest, place a sponge or thick glove between it and the rifle. Otherwise, the muzzle jump at firing will bounce the rifle upward off the hard surface and give you a shot that is high, and when you

Sighting-in setup can be simple card table, folding chair, a glove, rolled sleeping bag or sandbag for barrel cushion, binoculars as spotting scope.



Shotgun is pointed rather than sighted. Proper fit helps determine accuracy and measurements shown at right can be adjusted or altered by gunsmith.

correct for it, the rifle will shoot low when the rest is no longer used.

The steadiest positions are prone, (down on your stomach) or sitting at a bench or table. If there is a rifle range nearby, use it by all means. It usually offers fixed target holders, measured distances and shooting tables and positions. Otherwise, find a safe open area with a good backstop and pace off the desired range. Shoot from a prone position or use a folding chair and card table.

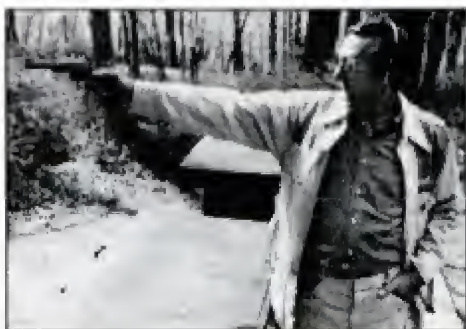
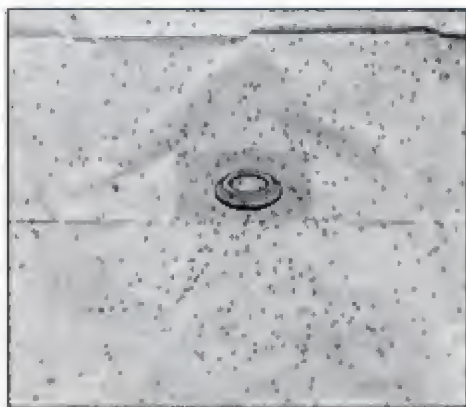
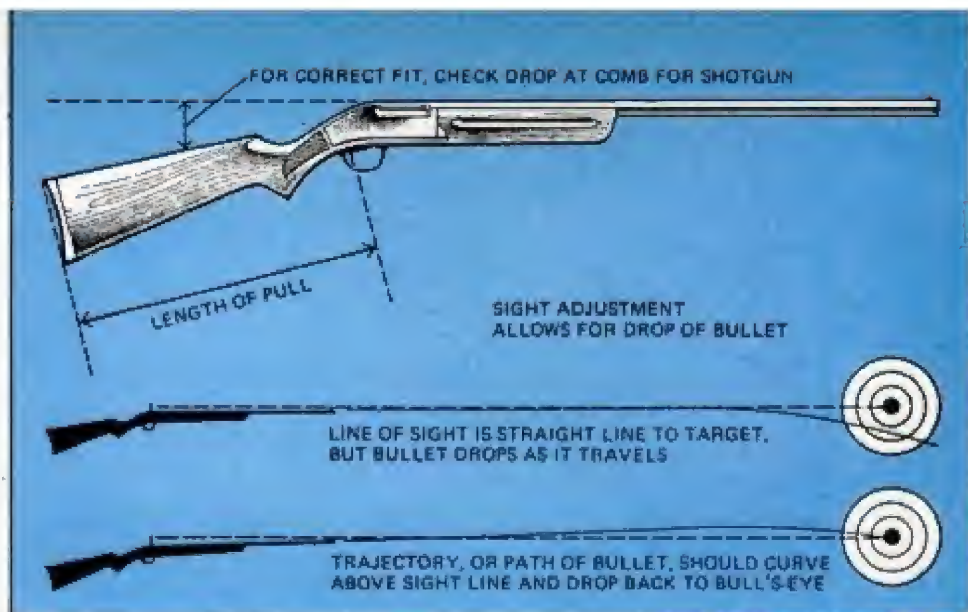
For .22-cal. plinking rifles, sight-in at 25 or 50 yards, or the distance you prefer. Most hunting rifles in .22 cal. or the larger centerfire calibers are best zeroed-in at 100 yards.

Sighting-in your rifle

Here's the procedure for sighting-in. Set up your target and fire two shots as carefully as possible. Squeeze slowly and avoid jerking the trigger. If the two shots are on the paper and within a few inches of each other, mark the point midway between them and adjust the sights to move this point toward the bull's-eye. You always move the rear sight in the direction you want the bullet to go. If the group is low and to the left, for example, move that rear sight higher and to the right. If your first two shots don't even hit the paper, move your rest closer to the target until they do. Work the group in toward the bull's-eye, then return to your 50 or 100-yard position and make your final adjustments.

Final groups should be three shots and the zero should be in the middle of the triangle formed by the three holes. Many shooters wonder how small these final groups should be. This depends on you and your equipment. Generally, at 100 yards using open sights, you can expect three to four inches between the two most widely separated shots. Peep sights should reduce this to two to three inches, and telescopic sights could narrow it down to two inches or less. Many rifles and shooters will do even better. At 100 yards, top marksmen can cover five-shot groups with a nickel. For zeroing-in at 50 yards, divide the above figures by two; and at 25 yards, by four.

If you can't achieve groups as small as those mentioned, you may not have a steady enough rest, you may be jerking the trigger, your sights may be loose (check all mounting screws) or, sadly, you may just have a rifle of poor accuracy and need a better one.



Grouping for shotgun (upper left) shows pattern clustered properly around clay pigeon picture. Rifle two-shot groups (above) are moved toward center by moving rear sight in same direction. Experienced handgunner can fire five-shot groups offhand for zeroing-in.

Shooters who sight-in rifles or switch sights frequently should consider purchasing a collimator. This device is hung on the end of the rifle barrel and permits preliminary sight adjustments before firing that should get your initial shots on the paper. They cost about \$15 to \$25. And if you become a frequent rifle range shooter, a spotting or target scope lets you see where your bullets are striking without your leaving the shooting position.

Bullets, of course, are subject to the law of gravity and start dropping the instant they leave the rifle muzzle. Your line of sight will be a straight line to the target, but the bullet must follow a curve above the line of sight. As a result, a rifle sighted "dead on" at 100 yards will shoot a bit high at 50 yards and low at 150 and beyond because of bullet

drop. Major ammunition manufacturers like Federal, Remington and Winchester include trajectory charts in their ammo catalogs so you can determine where a bullet will strike at other than zeroing-in range and enable you to zero-in your rifle for, say, 200 yards while shooting at a 100-yard target.

Handguns

In general, handguns are less accurate than rifles and are shot at much shorter ranges. Proficiency is more difficult, and a beginner should try to get expert instruction. Some handguns without adjustable sights are acceptable for short-range plinking, but rear sight adjustment is needed for serious marksmanship.

Most experienced handgunners will zero-in their sights by shooting

(Please turn to page 154)



Gear up for snow

by Glenn S. Hensley

Get a machine that meets your needs, learn to use it efficiently—and you can easily send snow packing.

Snow is beautiful—to most people. But to designers of snow-removal equipment, it's something else again.

"From an engineering point of view, snow's a mean and miserable product of nature," says John Posewitz of Gilson Bros. "It varies in density from feathers to rocks; varies in stickiness from talcum powder to molasses. It's a real achievement that modern snowblowers and throwers will effectively handle this stubborn substance."

In addition to snowblowers and throwers (there is a difference), there are blades (dozer type or "V") and rotary power brooms. Let's look at each of them.

■ **Snowblower.** Engineers at International Harvester Co. point out that this type of unit is generally used on self-propelled, walk-behind machines. It has a low-speed auger that feeds the snow into a higher-speed fan and paddle arrangement. Though this design generally requires less horsepower, it makes for a longer overall unit. It is a two-stage machine.

■ **The snowthrower,** by contrast, consists of a single, high-speed auger with paddles at the center to throw snow up and out a chute. The more paddles on the auger, the less pulsation the snow stream will have, and the more snow it will throw if proper-

ly designed. These are single-stage machines and are usually used as attachments on garden tractors.

Some small throwers use a rotary rubber paddle system to toss snow through a "venetian blind" deflector. For light duty, they are relatively inexpensive and easy to store.

Snowblowers and throwers are probably the best types of units for most snow-removal tasks. These units remove snow from areas with selective, directional throw; discharge chute rotation ranges up to about 250°. They are capable of handling heavy and light snowfalls efficiently, tossing the snow from 3 to over 40 feet. There might be some clogging in wet snow, engineers caution.

Blade may reduce area

■ **Dozer-type or "V" blades** do not really get rid of snow. They just shove it from one place to another as space, traction and power allow. Repeated use of a blade for clearance can eventually lead to a snow buildup along the side of a walk or driveway, reducing usable area. Heavier snowfalls often impair traction, hampering proper clearing. Blades on tractor-mounted, front-end loaders can, however, scoop up snow and haul it out of the way.

■ **Power brooms** are fine for light, dry snow, but they have limitations. Engineers point out, for instance, that brooms tend to clog during use and bristles may freeze up. But if you need to brush away a light cover of powder snow, a broom will work well. Besides that, you might be able to use it for other duties during the

year, such as brushing leaves off a walk.

Naturally, a major consideration (in addition to finances and your local average snowfall) is the kind of space that must be kept open around your house.

Throwers and blowers work well on hard surfaces like concrete or blacktop. Over grass, they are also effective and handy, but on gravel surfaces, or areas littered with trash, they must be operated with great care. They can send rocks and sticks soaring into orbit (or into your neighbor's picture window.)

Blades do a good job on gravel or hard surfaces, but they play havoc with sod. Brooms perform best on hard surfaces, but remember, they too can catapult gravel and debris.

Outdoor equipment specialists caution that the time you have available for snow-removal tasks needs to be taken into consideration. For example, an average fast, snow-clearing speed is about 2 mph. At this speed, an implement 44 inches wide clears about 525 square feet a minute, requiring somewhat more than half an hour to clear half an acre. A smaller unit, only 26 inches wide, clears about 325 square feet of snow a minute, requiring a bit more than an hour to clear the same half-acre.

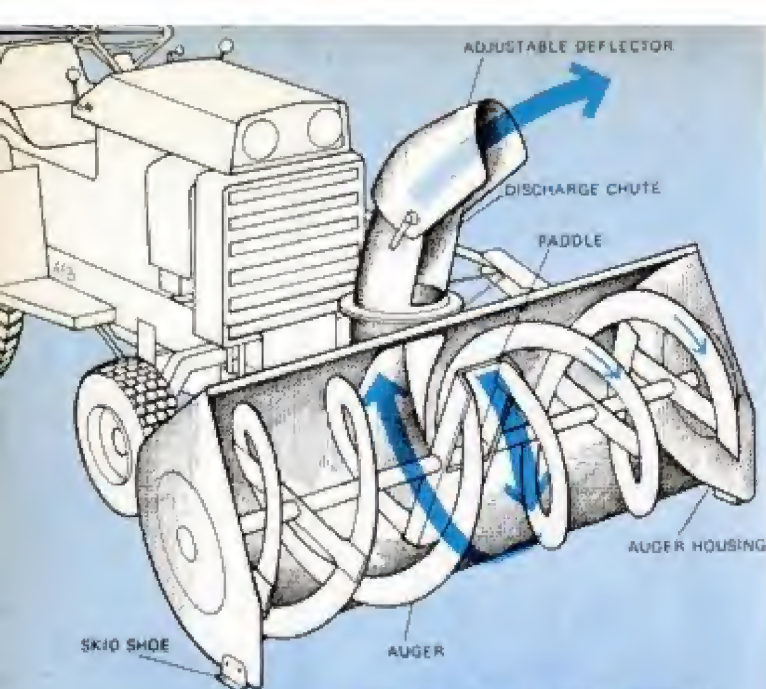
Wider cut, higher price

What will your new machine cost? Walk-behind, self-propelled snow throwers/blowers that clear 30-inch paths will cost you from about \$550 to over \$700. Six-hp machines, clearing about 24 inches, are priced from about \$400 to more than \$500. Four

Guide to new snowmovers

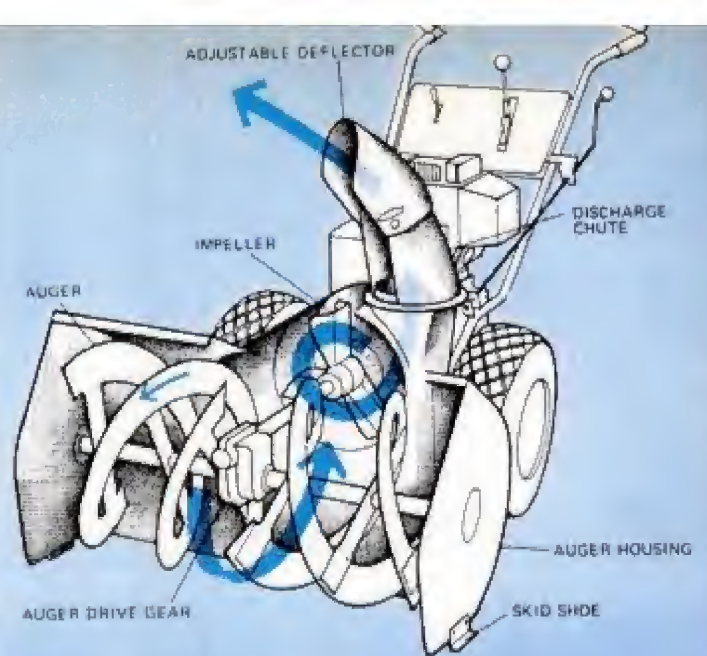
Make/Model	Walk Behind	Tractor Mounted	Hp.	Starter	Speeds	Stages	Width of Cut (in.)	Optional Accessories
Allis-Chalmers 28	x		8	Recoil	3-F, 1-R	2	28	Electric start, tire chains
24	x		5	Recoil	2-F, 1-R	2	24	Tire chains
21	x		4	Recoil	1-F, 1-R	1	21	Tire chains
AMF 1362	x		8	Electric	4-F, 1-R	3	26	Windshield kit
1360	x		5	Recoil	4-F, 1-R	2	26	Electric start, windshield kit
1364	x		5	Recoil	1-F, 1-R	1	20	Electric start
5604		x					36	
5586 (blade)		x					40	
Ariens 832D	x		8	Recoil	5-F, 1-R	2	32	Electric start, customer maintenance kit, chains, slicer bar, differential kits
824D	x		8	Recoil	5-F, 1-R	2	24	
824D	x		6	Recoil	5-F, 1-R	2	24	
624C	x		6	Recoil	4-F, 1-R	2	20	
520C	x		5	Recoil	4-F, 1-R	2	20	
420C	x		4	Recoil	4-F, 1-R	2	18	
48ST		x				1	48	
38ST		x				1	36	
42FB (blade)		x				1	42	
Bolens (FMC) 832	x		8	Recoil	4-F, 1-R	2	32	Electric start, slicer bar, roller kit, mittens, protective cab
826	x		8	Recoil	4-F, 1-R	2	26	
726	x		7	Recoil	4-F, 1-R	2	24	
625	x		6	Recoil	4-F, 1-R	2	24	
524	x		5	Recoil	4-F, 1-R	2	24	
Columbia (MTD) 950-5	x		8	Recoil	5-F, 2-R	2	33	Electric start
850-5	x		8	Recoil	5-F, 2-R	2	26	
430-5	x		5	Recoil	1-F, 1-R	1	21	
230-5	x		5	Recoil	1-F, 1-R	1	20	
Gilson 55012	x		8	Recoil	3-F, 1-R	2	28	Electric start, tire chains and customer maintenance kits for 5-8-hp models
55010	x		8	Recoil	3-F, 1-R	2	26	
55011	x		5	Recoil	3-F, 1-R	2	26	
55010	x		5	Electric	3-F, 1-R	2	26	
55008	x		4	Recoil	1-F, 1-R	2	18	
Gravely		x				2	44	Hydraulic lift, enclosed cab
		x				2	34	
		x				2	28	
Homelite S-8	x		8	Manual	3-F, 1-R	2	28	Electric start
S-4	x		4	Manual	1-F, 1-R	1	21	
International Harvester 328	x		8	Recoil	4-F, 1-R	2	32	Electric start
268	x		8	Recoil	4-F, 1-R	2	26	
265	x		5	Recoil	4-F, 1-R	2	26	
C-32		x				1	32	
C-36		x				1	36	
QA-36A		x				1	36	
QA-42A		x				1	42	
IH-50		x				1	60	
Jacobsen Imperial 30	x		8	Recoil	4-F, 1-R	2	30	Electric start, tire chains
Imperial 20	x		6 or 8	Recoil	4-F, 1-R	2	26	Electric start, tire chains, drift slicer bar
Imperial 20	x		5	Recoil	1-F, 1-R	1	20	Electric start, tire chains
Snow-Blitz II	x		2	Recoil	Not self-propelled	1	NA	Dual handles for holding when clearing steps
Massey-Ferguson 288	x		8	Recoil	4-F, 1-R	2	26	Electric start
Snowblade		x				1	up to 48	
Snowthrowers		x				1	34 to 44	
Toro 1032	x		10	Electric	3-F, 1-R	2	32	Tire chains, drift breakers, cab housing
832	x		8	Recoil	3-F, 1-R	2	32	Electric start, tire chains, drift breaker, cab housing
826	x		8	Recoil	3-F, 1-R	2	26	Electric start, chains, drift breaker, cab, heavy-duty skids
724	x		7	Recoil	3-F, 2-R	2	24	Same as above
524	x		5	Recoil	3-F, 2-R	2	24	Same as above
Snow Hound	x		3.5	Recoil	1-F	1	20	
Snow Master	x		2	Recoil	Not self-propelled	1	21	
Snow Pup	x		2	Recoil	Not self-propelled	1	14	
Wheel Horse 8-7452		x				1	48	
6-6214		x				1	42	
6-0202		x				1	37	
6-1142 (blade)		x				1	50	
8-0740 (blade)		x				1	42	
Yard-Man 7200	x		8	Recoil	5-F, 1-R	2	30	Electric start, tire chains, lighting kit, vinyl cover
7100	x		7	Recoil	5-F, 1-R	2	26	Same as above
Blade		x				1	38 or 42	
Snowthrower		x				1	32	

Key to abbreviations: F, forward; R, reverse; NA, not available. Note: Most major makes are included, but not all models in a particular line.



Single-stage snowthrower

High-speed auger moves snow to center, where paddles propel it up discharge chute. Usually, single-stage units attach to tractor.



Two-stage snowblower

In snowblower, low-speed auger feeds snow to fan or impeller. Generally, this design requires less power than snowthrower.

to 5-hp units average from about \$350 to over \$475. Units to mount on existing 12, 14 or 16-hp garden tractors can cost from a low of just under \$400 to over \$500. Blades for this size garden tractor are priced from about \$100 to over \$150.

Throwers for garden tractors of about 8-hp cost in the neighborhood of \$400, and blades for these tractors top the \$100 mark.

Width of clearing in one pass ranges from 14 to 32 inches for walk-behind, self-propelled models. Garden tractor-mounted throwers range in width of cut from 32 to 48 inches.

Forward speeds available range from one to as high as five. A reverse drive gear is a highly important feature, as is the ability to lock in or out the power for each traction-drive wheel.

Speeds provide flexibility

I like a machine with at least three forward speeds. With this flexibility, I have a slow speed for maneuvering into dense drifts and a high speed for galloping through a light layer of snow with at least one intermediate speed for in-between snow depths.

In these days of high-priced fuel, there's ample incentive to cut power costs in operating snow-removal machines. You can save both time and money if you throw the snow to only one side. Start from the side opposite to where the snow will be thrown. At the end of each pass, rotate the discharge chute 180° for the return pass. This will keep the direction of snow discharge all on one side.

In an alternate pattern, try, where possible, to throw snow to the right and left by starting your removal pass directly down the middle of the area. Plow from one end to the other, throwing snow to each side without changing the position of the chute.

Most manufacturers urge that their machines be operated at full throttle for maximum power. In deep or drifted snow, it's most economical on fuel to drive the auger into the snow, disengage the traction drive and allow the auger to chew up and spit out its load. Repeat this procedure until you get a path cleared. On the second pass, overlap the first pass just enough to allow the auger to handle the snow without repeated engaging and disengaging of power to the wheels.

Here are other tips you may find useful:

- International Harvester engineers say that if your unit is normally stored in heated quarters, allow the machine to cool to outside temperatures before operating. This will help prevent snow from sticking to the auger-impeller housing, discharge chute and deflector cap.

- If you're worried that the cold engine might be hard to start, remember most units provide for optional 110-volt electric starting. That's a worthwhile option.

- If, after use, the unit is allowed to stand in a freezing temperature, be sure snow and ice are removed from the auger and impeller areas as heavy icing could cause damage when you put the machine in gear again.

- Be certain the discharge chute assembly is free. Don't force any part that appears to be frozen.

- If you're concerned about free snow discharge and possible plugging, remember that moderately dense snow will rarely plug any snow-removal machine. Unfortunately, snow does not always come the way we want it. Authorities suggest that the best way to prevent any machine from plugging is to keep the auger and impeller as full as possible. This maintains pressure from the impeller on the snow flowing through the chute.

A sufficient volume of snow coming into the chute will push out the heavier snow which tends to plug up. A practical way to accomplish this is to operate the snowthrower over the ground as rapidly as possible. Use the highest traction drive speed that is prudent from a safety standpoint.

- It's a good idea to control the snow-throwing distance by leaving the machine's chute deflector at the highest position and then cut down on throwing distance by slowing engine rpm. This way there is less tendency for the chute to plug with wet snow.

A book could be written on operating tips and suggestions, but the best source for such information is the operating manual that comes with your snow-removal machine when you buy it. It will be packed with directions, suggestions and safety precautions. Do what it says—and you'll keep your problems to a minimum. You might even enjoy getting rid of that white stuff. ★ ★ ★

IT'S NEW NOW



New projector for 110 'pocket' slides

Light (6¼ pounds), sleek and compact, this new Pradovit projector from Leitz shows 110-size (Pocket Instamatic) slides, and uses the same 60-slide rotary tray as several other foreign manufacturers, for easy interchangeability. It's \$279 with 50-mm lens, \$237 with a 45-mm.



They grow 'em big in Australia

That's no fake blossom above. It's a real, honest-to-goodness sunflower more than a foot in diameter. The mammoth flowers are being cultivated in Australia as part of a program to increase the production of oilseed crops to meet a growing world demand for vegetable oils. Research has produced hybrid strains that are not only big but extremely hardy, being able to withstand sudden night frosts that kill other flowers.

The Concorde is coming

Like a giant prehistoric bird, a British Airways Concorde lumbers into London's Heathrow Airport to begin a series of shakedown flights before going into regular overseas service. As part of the break-in program, the huge supersonic jetliner—one of the first to be built—is scheduled to cross the Atlantic four times a day for six days running—a rugged test of ship and crew endurance. It will also make 11,500-mile nonstop hops between London and Melbourne, Australia. Other of the jointly designed British-French SSTs are already in service, making runs from Paris to Rio de Janeiro.



Digital darkroom timer

Digital readout not only makes this darkroom timer easier to read; it makes it easy to read in the dark—and its red LED display won't fog enlarging paper. Set any time up to 99 seconds, push the button and you can watch the seconds count down to zero. That's a help when you're dodging, burning in or vignetting prints, and it also lets you use the unit for manual timing or for automatic enlarger control. Distributed by Matrix Systems, Ltd., 408 West Grand Ave., Chicago, Ill. 60610.

Versatile appliance control

You can program this electrical plug-in timer for up to 12 on-off operations a day merely by pressing buttons around its dial. Called Touch Command, it can turn house lights on and off when you're away in what appears to be a random sequence. Or it can have your coffee perked when you awake, your roast done when you get home. \$11.95; Paragon, 606 Parkway, Two Rivers, Wis. 54241.



Flashy faucets in color

Plastic faucets in colors to match a colored sink are the latest decorative addition to a modern kitchen. Made of Celcon, the single-handle controls have only one moving part, no washers to need changing, are said to be virtually wear and damageproof. Sold with sinks or in colors to match most sinks. Webstone Co., Inc., 38 Harlow St., Worcester, Mass. 01605.



PM OWNERS REPORT: VOLKSWAGEN RABBIT

Can the Rabbit live up to the standards set by the Beetle?

A nationwide survey based on 1,690,959 owner-driven miles

by Michael Lamm WEST COAST EDITOR

The virtues that made Volkswagen so popular in the Beetle's heyday all have to be reproven in the new Rabbit. Does the Rabbit share the Bug's longevity, durability, its workmanship, **overengineering**, economy of operation, fantastic resale value?

Is dealer service on a par? What's the parts situation? In which ways is the Rabbit better than the Beetle? In which ways is it worse?

For answers to these and other questions we've turned to this country's first wave of owners and asked for their Rabbit tales. The replies we received represent an accumulation of 1,690,959 miles of driving experience.

On the topic of workmanship and general quality, the majority—44.7 percent—rated the Rabbit "good," with 27.1 percent giving it a mark of no less than "excellent." That's high praise, indeed, especially for so new a car. A Florida airconditioning man summed up most owners' feelings this way: "Design and engineering are excellent, and workmanship is up to Volkswagen quality."

Not everyone, though, agreed. A Michigan store manager had this to say: "Our Rabbit is the standard model that was first introduced at \$2999. I now feel not paying the extra \$300 for the deluxe version was a mistake, because the Rabbit without trimmings is nothing but a cheap little metal box. The sound insulation is terrible, so the car is noisy; the all-drum brakes are extremely poor; the back seat is a pain to move forward; and the seats fore and aft are uncomfortable. The factory cut every corner on quality and workmanship in this car."

What about economy? Our very first VW Owners Report way back in Oct. 1956 stated that the 36-bhp Beetle averaged 28 mpg overall. For the 1975 Rabbit, the EPA says 24 city and 38 country driving. But their figures are determined on a dynamometer. Rabbit owners got 25.5 mpg in town and 32.4 mpg on long trips. This was with manual-transmissioned cars. Rabbits with automatics and/or airconditioning do slightly worse. So all in all, it's probably safe to say that today's VWs still average about 28 mpg overall.

The Rabbit, though, has a good deal more power than even the newest Beetle. Performance is greater by a considerable margin, and owners are very pleased with the way

Beetles are so overengineered that flat out they're merely loafing. Whether the Rabbit can stand up to the stresses of jackrabbit driving remains to be seen.

People rave about interior roominess. It's a product of squared-off lines, jigsaw fits and thin doors.

Some owners of standard Rabbits say they've removed door panels and stuffed crevices with padding to cut noise.

No choppiness despite the short wheelbase, and the firm springing makes for excellent cornering stability.

Here's where the Rabbit really shines. Considering the power, gas mileage is really phenomenal.

their Rabbits go. "Zip is outstanding; really fantastic," says an Iowa teacher.

A California aero engineer comments, "I'm amazed and very pleased with the match of engine power to transmission and axle ratios. The Rabbit has much better performance than previous VWs we've owned, the higher rpm limits being one big improvement." And from an Illinois salesman: "Tremendous pickup for a small car—better than my Porsche 914."

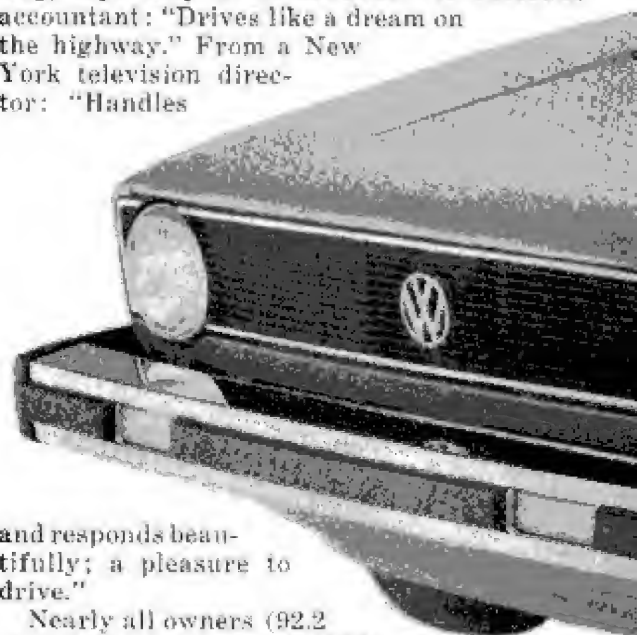
Handling ranked No. 1 among "specific likes," evoking these comments among others: "It is fun to drive—fast, agile, feels really safe on the road, and incredibly responsive."—Illinois psychologist. The Rabbit's transverse, front-mounted engine and front-wheel drive get credit for excellent traction in wet and snow, for smooth pulling through sharp turns with full power on, and for adding to usable space inside the car.

A Green Bay police officer avers, "My Rabbit handles 10 times better than my previous Bug, especially in crosswinds." A Colorado accountant: "Drives like a dream on the highway." From a New York television director: "Handles

and responds beautifully; a pleasure to drive."

Nearly all owners (92.2 percent) gave the Rabbit marks of "good-to-excellent" on comfort. Seats were judged good, so was ease of entry and exit, and although many people commented on the firm suspension, no one complained of harshness. Some minor complaints centered on the gas pedal being too small.

Some owners, too, mentioned interior ventilation, suggesting it might be improved by





Photos by the author

Interior spaciousness was praised by owners, though styling evoked little comment. Transverse engine is easy to get at, but short dipstick causes singed hands.



Rabbit's seat belts, once adjusted, automatically drape across chest, need no buckling or unbuckling. But clasps break easily.



Too bad these belts aren't fault-free; because they look like a good alternative to airbags.



Rear seat folds flat for large cargo area. There's even a hidden bin beneath parcel shelf. Sedans and coupes have rear liftgates.

adding front vent wings and openable rear side windows. "And the airconditioner outlets," said a North Carolina photographer, "are at waist level, so cool air never reaches a person's head and shoulders."

Dealers and dealer service were generally judged good, but fully a third of our respondents weren't happy. "A part for the door was supposed to be here at the 1000-mile checkup, but here it is seven weeks later and it's still not in," grumbled a Kodak employee. And a New York electronic musician: "It took the dealer over six weeks to receive a new aluminum transmission case for my idle Rabbit. I dislike dealer incompetence, the high price of parts, and the long wait. If I shut my eyes, I can pretend my Rabbit is an honest-to-God sports car, but does it have to fall apart like one?"

Among general complaints, squeaky brakes turned up most often, followed closely by notes on black brake powder on the front wheels. Both the squeaks and the powder come as standard equipment with front discs, not just in Rabbits but in many other makes of cars. The powder washes off, but so far there's no surefire cure for the squeaks.

Catalytic converter problems also cropped up fairly often, some owners saying they'd had to have them replaced. Others would rather be without them, presumably so they wouldn't have to buy unleaded gasoline.

Long waits for parts are common—should improve as Rabbits replace Beetles on America's highways.

It's the slotted wheel design that lets the powder through. Audis and Dashers have the same problem.

The Rabbit's door-mounted seat belts work automatically; once set, they needn't be buckled or unbuckled each time the driver enters or leaves. But several owners noted that the system's buckles and attachments tended to break or were weak.

It appears, though, that Rabbit owners are getting caught up in the same sort of love affair that immortalized the Beetle. For example, an RN in Buffalo laments that, "... my husband loves our Rabbit so much that he won't let me drive it when we're out together."

And in California a bookbinder rhapsodizes: "It's a neat car, because it does everything a big one will do, like carry five people and lots of groceries, but it parks in tight places, gets good gas mileage, and goes great. Who needs more?"

An interesting reason for buying a Rabbit was disclosed in our survey, and it was a first: "Ecological reasons," says a Michigan social worker. "The car conserves gas, material and space."

It is a realty sales manager from Kansas who has, perhaps, the last word on the Rabbit. He bought his four-door for economy, looks and handling, but he has had his share of problems. Still, he'd buy another, and he concludes:

"When the 'kinks' are out I feel it will be a fine car." ★★★

Summary of 1975 VW Rabbit Owners Reports*

Total miles driven 1,670,959

Average miles per gallon

Manual transmission	
Local driving	25.5
Long trips	32.4
Automatic transmission	
Local driving	24.1
Long trips	27.9

Body styles

Two-door hatchback	74.6%
Four-door sedan	25.4

Transmissions

Manual	83.6%
Automatic	16.4

Why did you choose the Rabbit?

Economy	73.5%
Handling	20.8
Performance	14.6
Styling	12.4
Size	11.5

Specific likes:

Economy	63.2%
Handling	61.8
Comfort	27.0
Power	24.4
Roominess	20.8
Performance	18.5

Specific dislikes:

Squeaky disc brakes	19.4%
Getting parts	11.0
Catalytic converter	9.8
Poor workmanship	9.5
Poor ventilating system	9.0

What changes would you like?

Better ventilating system	14.7%
Bigger gas pedal	8.4
Remove catalytic converter	7.8
Better materials	6.9

Dealer sales policy:

Good to excellent	69.4%
Average to poor	30.6

Workmanship opinion:

Good to excellent	71.8%
Average to poor	28.3

Comfort opinion:

Good to excellent	92.2%
Average to poor	7.7

Number of vehicles owned:

Rabbit only	42.9%
Two cars	42.3
Three cars	10.9
Four or more cars	3.9

Makes of other cars owned:

Chevrolet	23.4%
Volkswagen	22.0
Ford	17.1
Oldsmobile	10.2
Plymouth	7.3

Had any mechanical trouble?

Yes	70.5%
No	29.5

What type of trouble?

Carburetor and hesitation	23.2%
Catalytic converter	17.2
Brakes	13.2
Electrical	11.6

Did you repair it yourself?

No	96.4%
Yes	3.6

Dealer repairs satisfactory?

No	50.4%
Yes	49.6

Dealer service opinion:

Good to excellent	54.2%
Average to poor	45.8

Age distribution of owners:

15-29 years	44.5%
30-49 years	39.4
50 and over	16.2

Would you buy another Rabbit?

Yes	78.6%
No	21.4

*Percentages might not equal 100% due to rounding or insufficient data.

IT'S NEW NOW



Safe plastic 'welding' kit builds race cars

Plastic members are "welded" by young craftsmen to build two racy cars with this Mattel kit. Spinwelder uses spinning plastic nib in battery-powered, gunlike tool to generate enough friction heat to join plastic pieces. Joints can be pulled apart, rewelded if desired. When cars are finished, tool is used to set flywheels spinning so cars can zoom up to 60 feet. At toy, department stores.



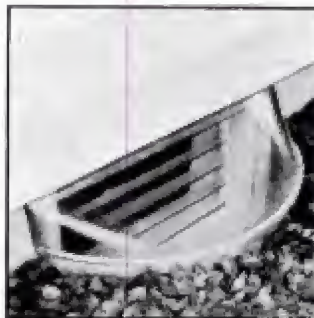
Prefab basement windows

Factory-prefinished basement window unit has dual-position hinges and lock strike, allowing use in either awning position shown or hopper position, both swinging inward. Unit is weather-stripped at the factory and a screen is supplied with it; removable double glazing is optional. Available in three sizes; prices start at about \$20. Andersen Corp., Bayport, Minn. 55003.



Portable diving board

All the strength, stability and bounce of a full-sized board are claimed for Port-a-Dive, a take-anywhere diving board for pool, dock, float or boat deck. Oak board has nonslip surface; tubular steel frame has baked enamel finish. Maker says any diver can hit Port-a-Dive hard without worry about tipping or creeping. \$95 prepaid from Sylvan Industries, 614 East Purl St., Goshen, Ind. 46526.



Window well cover

For semicircular basement window wells, plastic cover keeps out rain, snow, leaves; lets in light, adjusts for ventilation. Maker says assembly, installation take just 15 minutes. \$7.95 postpaid; Williamson, Box 503, Cherry Hill, N.J. 08003.



Aluminum 'shakes'

This textured aluminum siding gives the look of hand-split shakes without requiring the maintenance they do. Available in solid colors or pattern effect. Great American Shakes from Alcan Building Products, Box 511, Warren, Ohio 44482.

Self-propelled vacuum cleaner

Pushing and pulling are automated with Powerease vacuum cleaner—a light touch on the handle activates a motor that moves it forward or backward. Solid-state motor control offers choice of three speeds or "off" for tight quarters. Other features: full-bag signal, seven-height rug-pile adjustment, automatic cord reel, headlight, 3.7-quart capacity. About \$170 at Sears stores and through catalog.

First look at the '76s

by Bill McKeown BOATING EDITOR

Some boats offer a lot for the money—and this preview selection shows 10 we pick to be popular next year. Boating on a budget makes sense today. Building is one way to save, and buying carefully is another.

Back when there was a shortage of pleasure craft after World War II, constructing a kit was one shortcut for getting afloat. Now building your own boat is a way to afford the sport at as much as a 50 percent saving (since you don't count your time), and the manufacturers named on this page supply plans and parts for power and sail craft from dinghy size up to houseboats, sailing yachts and offshore cruisers.

If you're looking for a ready-made powercraft, shop for models designed with seakindly hulls at specified engine ratings, adequate accommodations and often cockpit space forward of the windshield, reliable noncorrosive fittings, secure grab rails, approved engine ventilation, all required equipment supplied, extras such as anchor and lines, transom swimming platforms or permanent boarding ladders for getting back aboard. When a boat incorporates these features—especially when they are included as basic equipment—you will get more for each dollar spent on the sport. ★ ★ ★



Center cockpit with a separate added cabin aft, or conventional stern cockpit, can be constructed from Glen L plans for the 25-foot Solo (above) or Duet sloop (right).

New sailboats to build..



Lugger Tradewinds, new 26-footer that is trailerable, sleeps five, has one-piece hull, deck for easy kit assembly. About \$4000 with sails.



For sailing, rowing, motoring with outboard, 11-foot Glen L 11 is home-built from \$15 plans in fiberglass over wood-strip sandwich core. Rigs as sloop or cat.



Eight Ball for beginner builders, this 7-ft., 10-in. sailing pram is \$8 for Glen L plans, \$45 for sail, plus cost of two plywood sheets. At about 75 lbs., it cartops easily.

Power boats to buy



Montego from Starcraft, with 188-hp MerCruiser, planes out at a swift and stylish 48.5 mph.

Chrysler's newest and largest, the Conqueror 21 has deep-V hull, 8-foot beam, stern drive or an optional V-drive. Deep roomy cockpit appears very suitable for family. Top, curtains are options.



Runabout looks plus inboard power, the Dolphin Centura with MerCruiser 140 sterndrive tops 40 mph, features forward cockpit, walk-through windshield, swimming ladder, bow-stern rails.



Glastron's new GT-150 ski-performance boat for '76 comes in red, white and blue with back-to-back bucket seats, deep-V hull, forward locker for skis, sweptback windscreen; rated to 93 hp.



V-Mate 1, from Checkmate Boats, is a hot-handling performer, has tested out at 48 mph with 85-hp Merc and one aboard, 45.5 with two. The V-hulled 15-footer can take outboards to 100 hp.

Driving Alfa Romeo's new Alfetta

by Bill Hartford AUTO EDITOR

Photos by the author

Head-in-the-sand drivers probably will not be interested in Alfa Romeo's new Alfetta models—for two reasons. They think Alfas are in the \$15,000 to \$20,000 range. That's way off base: The sedan is \$7000 and the GT \$8200—that's the price you have to pay for any new car of respectable quality these days.

The second reason is that the cars offer more than most American drivers know what to do with: They're extraordinarily well-balanced and suspended, and capable of quick, responsive evasive maneuvers. In a recent study done for GM by Calspan, the overwhelming majority of typical drivers tested in emergency situations either locked up their brakes or just plowed through the pylons placed in their path. This is a discouraging result, but it emphasizes the need for skilled drivers to be at the wheel of a car that lets them get

(Please turn to page 138)



Alfetta GT (above) and sedan (right) are a mile apart in looks, but share the same chassis, engine and drive train, including the transaxle shown below. Power is from Alfa's aluminum, dohc, two-liter Four with fuel injection. EPA highway rating is 25 mpg.



Alfa's racing heritage goes back to 1911 and includes the 1975 World Championship of Makes. At left: Rally-prepared GT and older GT Veloce. Above: GT and plaque of driver, Blondetti, on route of Mille Miglia in Italy.



Amazing new power from ocean depths

by Richard F. Dempewolff

Take warm water from the ocean's surface and cold water from its chilly depths and you have a "heat engine" capable of producing vast quantities of electrical power. Scientists have long known the principle, but until recently have lacked the means to put it into practice.

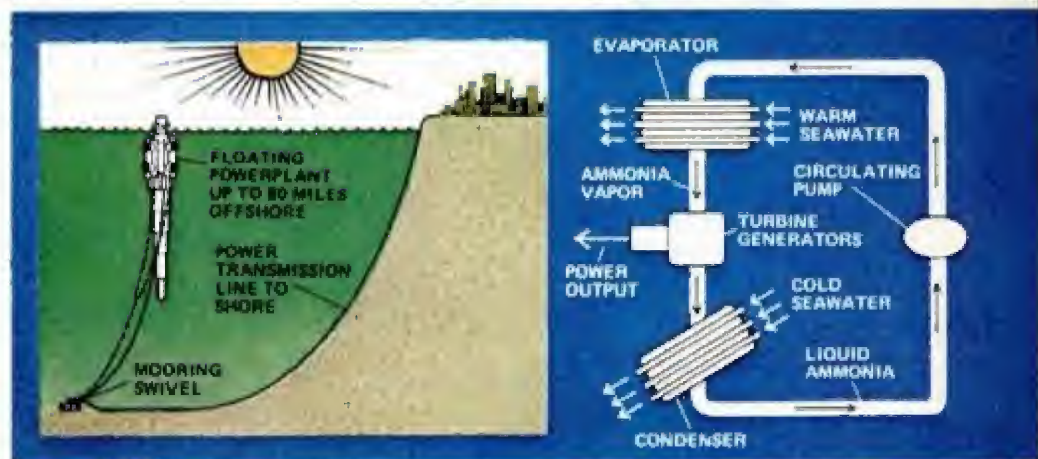
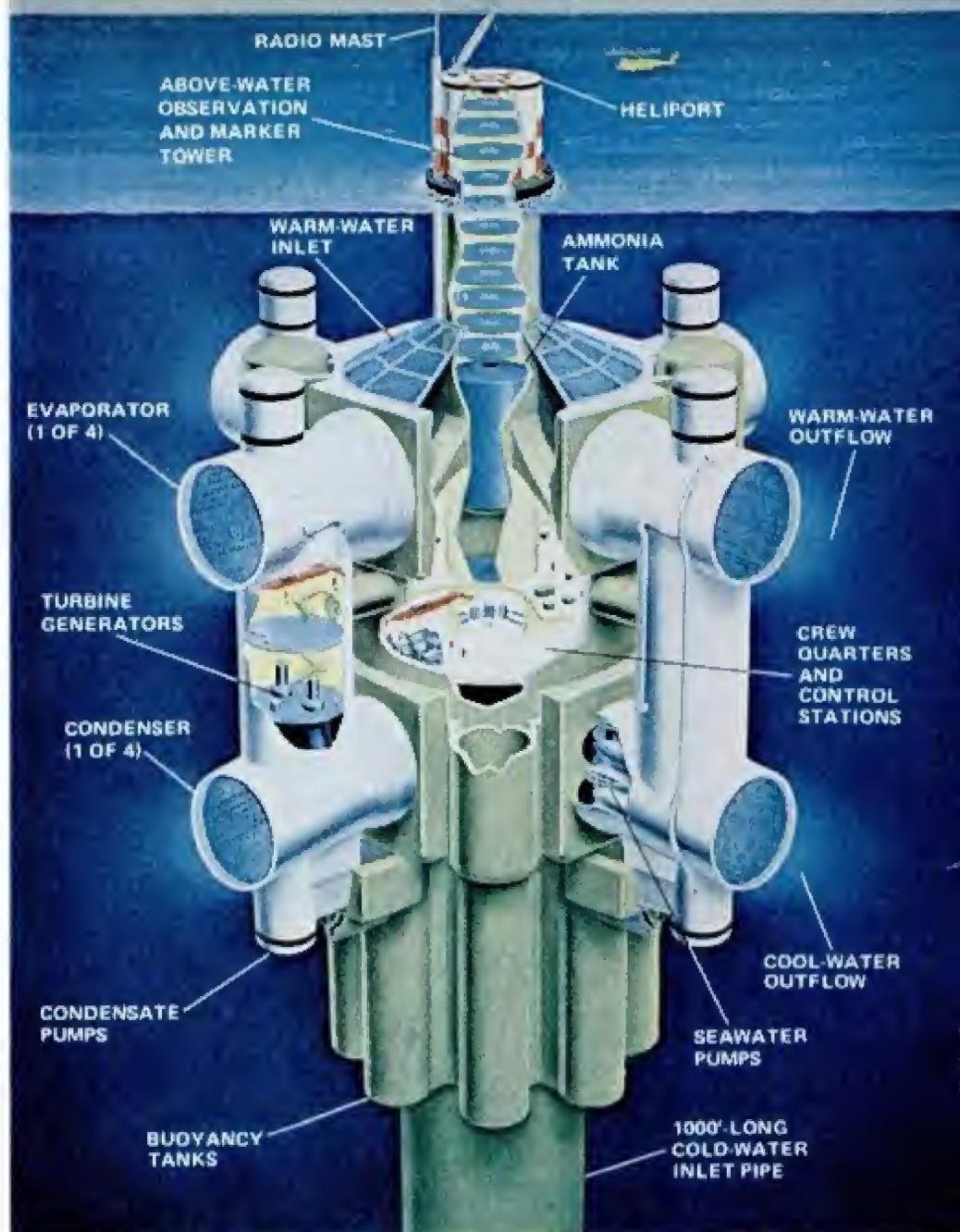
Now, under a federal program called OTEC—for Ocean Thermal Energy Conversion—are coming practical proposals for ocean-based powerplants whose "fuel" is merely a temperature differential in seawater. One of the most spectacular is a plan developed by Lockheed Missiles and Space Co., assisted by Bechtel Corp. and T. Y. Lin International.

Heated by the sun, the surface of the ocean runs 30° F. to 35° F. warmer than near-freezing waters farther down. This makes the sea a gigantic solar "storage battery" of thermal energy. Converting this energy into usable power requires turbines driven by a working fluid that vaporizes and condenses under relatively small changes in temperature—in this case, ammonia.

Pressure spins turbine

The ammonia is pumped through an evaporator warmed by surface water. Here it vaporizes, expands and its pressure spins turbine blades. The turbine, in turn, drives a generator that produces electricity. As the ammonia vapor leaves the turbine it passes through a condenser chilled by cold deep water. Here it condenses back into liquid form and is pumped around again to the evaporator in a continuing cycle, as shown in the diagram at lower right.

The process is basically simple—it's the equipment to make it work that becomes elaborate. The Lockheed design calls for an enormous floating factory—a huge tower-like structure, supported by buoyancy tanks, that rides almost fully submerged, like an iceberg. Some 250 feet in diameter, the monster extends more than 1500 feet deep. Sprouting from its sides are four self-contained



evaporator/condenser units, complete with power-generating turbines, circulating pumps and controls.

Warm surface water for the evaporators is scooped in at the top. Cold water for the condensers is drawn up from the bottom. Together the four power-generating modules produce 160 megawatts of electricity that can be piped up to 80 miles to

shore. Because the seagoing powerplant is submerged, it is unaffected by wind and waves. Tethered to a swivel mooring, it swings with the current, but can operate in hurricane-force storms. Best yet, unlike fossil and nuclear fuels, it wastes no vital resources, spews out no pollutants—indeed a promising answer to our mounting power crisis. ★ ★ ★



Build this tabletop hockey game for family fun

Color photo: Walter Kleka

by George M. Kaler

You'll soon find you have to be as quick as a fox to play hockey with an air-cushion puck. The floating puck travels at lightning speed on a cushion of air created by a fan and some 2360 tiny air jets in the playing surface. To block a flying, ricocheting puck, you have to be incredibly quick and just as fast to flash the puck past your opponent and score.

The player who scores six goals first is the winner. It's a fun, action-packed game the whole family will enjoy, and you can build it in a week-end.

Please take note that the name Air Hockey is owned by the Brunswick Corp., which also holds three basic patents on the game. The game may

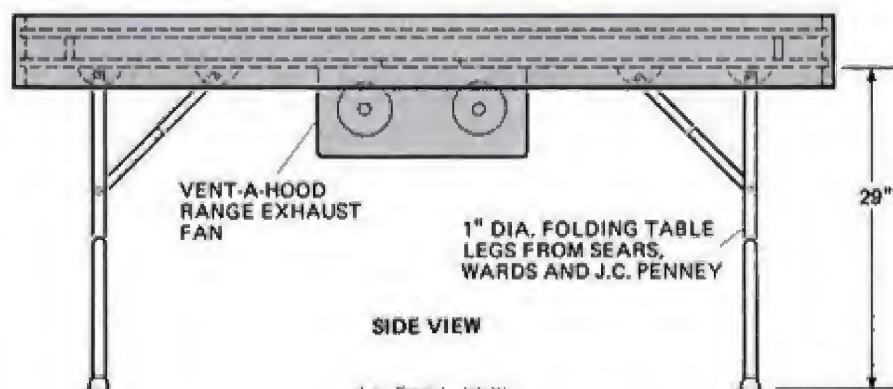
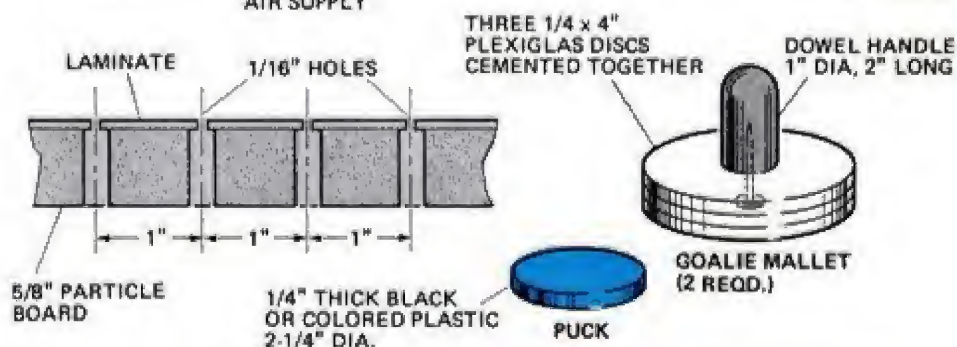
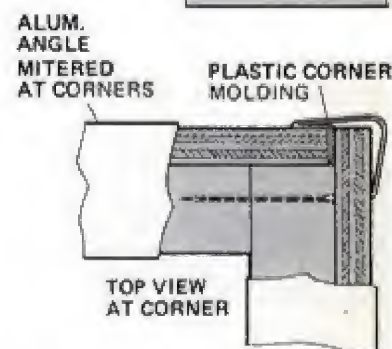
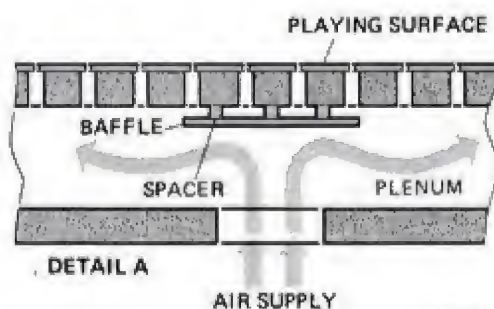
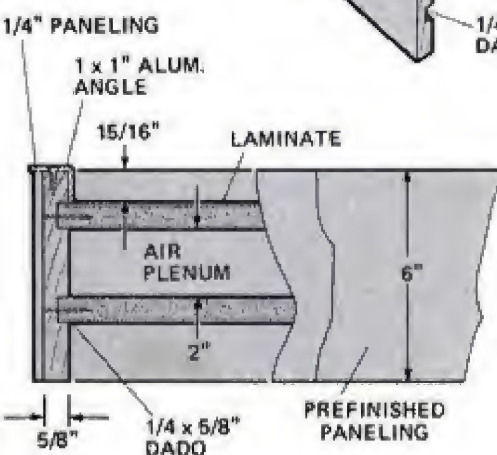
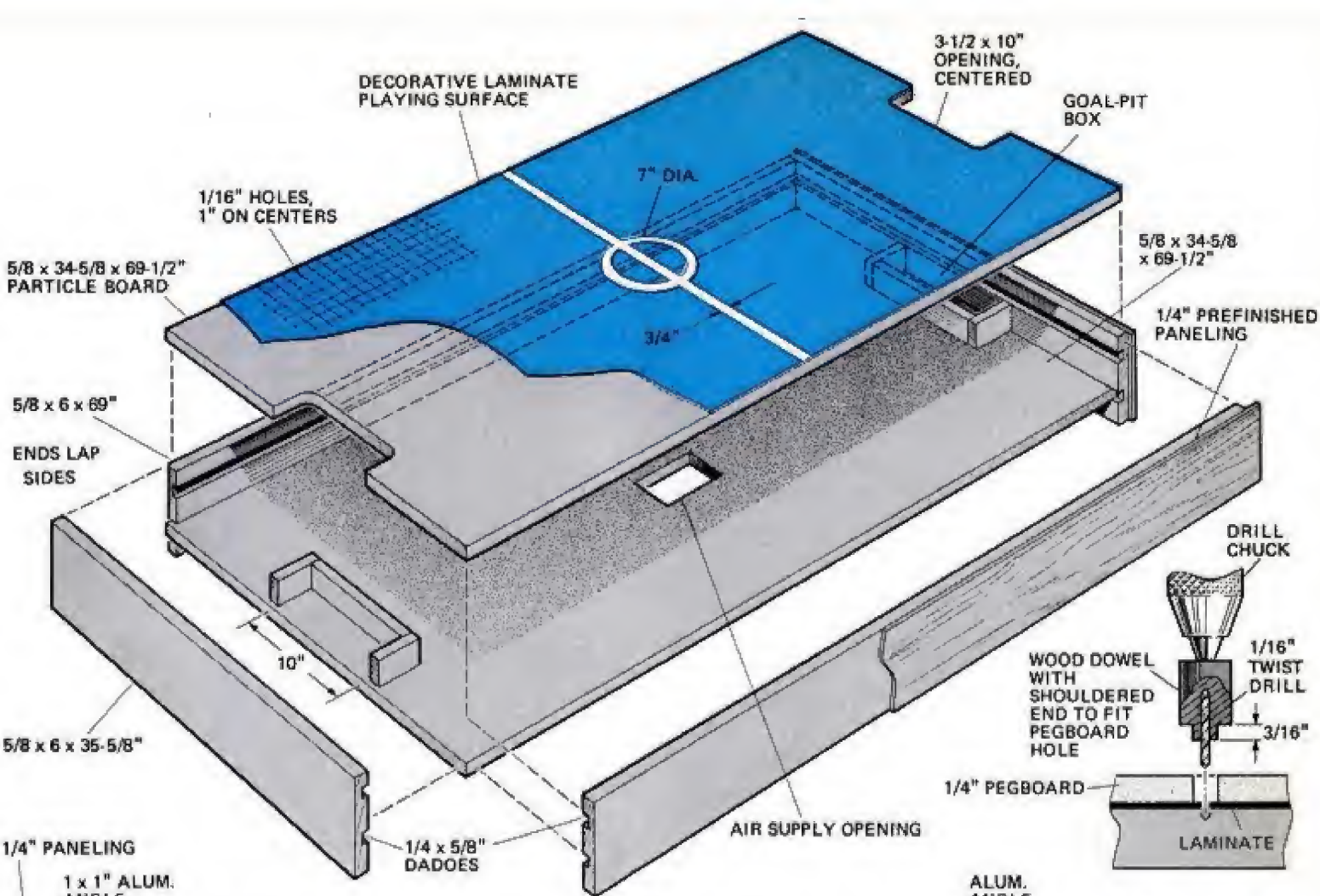


You can make your own goalie mallets and puck or buy them. Each mallet consists of three 1/4-in.-thick plastic discs that are cut with a fly cutter in a drill press and cemented together. A dowel held with a screw provides a handle.

be made for personal use but not for sale.

The playing surface is made first. It consists of a 5/8-in.-thick particleboard base honeycombed with 1/4-in. holes on 1-in. centers and a plastic laminate facing with an equal number of 1/16-in. holes. The particleboard is drilled first, then the laminate is cemented to it and the 1/16-in. holes drilled. The spacing and drilling of the 4720 holes is not the endless job it may seem, thanks to 1/4-in. pegboard which is used as a drilling guide for both sets of holes.

Cut the particleboard, laminate and pegboard the same overall size (34 5/8 x 69 1/2 in.) and see that holes in the pegboard are centered equally along the edges. Clamp the pegboard



Art: Fred L. Wolff

to the top of the particleboard, edges aligned, and with a 1/4-in. bit in your electric drill go from hole to hole in the pegboard.

Now cement the laminate to the particleboard with contact cement. Apply a coat to each surface, wait about 15 minutes until the cement is tacky to the touch, then bond the two together. Remember that once the coated surfaces touch, you can't shift them, so position the laminate carefully.

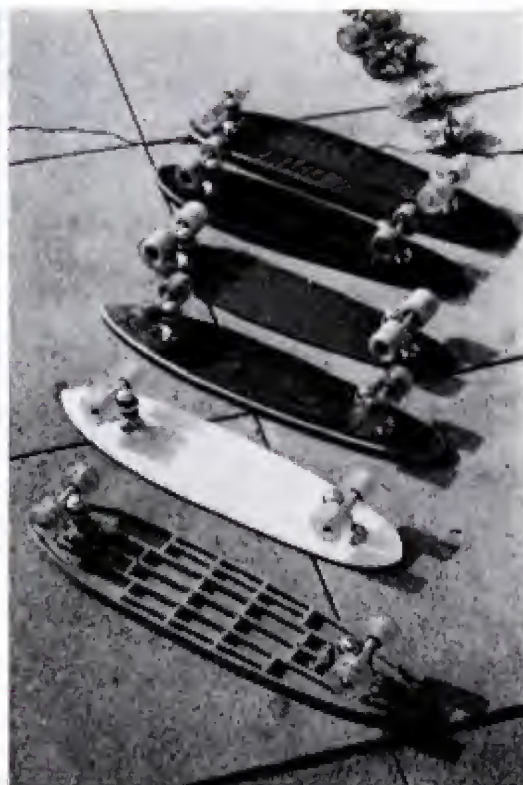
To drill the 1/16-in. holes using the pegboard you'll need to make a shouldered stop from a short piece of 1/2-in. dowel to center the bit in the 1/4-in. holes. The shouldered end can be formed with the dowel

(Please turn to page 136)

IT'S NEW NOW

Tudor wall from stick-on tiles

You wouldn't guess it to look at it, but this Tudor-style wall of white stucco and wood strips actually consists of self-adhesive vinyl tiles—you just peel off the back and stick them on. The 12 by 24-inch tiles come six to a pack for about \$4.50. Decro-Wall, Elmsford, N.Y. 10523.



Skateboarding is back—bigger, better, wilder than ever

Skateboarding, a dying sport by the end of the '60s, is making a comeback—and in a lavishly spectacular way. The original homemade boards—merely planks with ordinary roller-skate wheels—are being replaced by fancy new commercial models made of such exotic materials as laminated fiberglass, extruded aluminum and molded plastic (right, above). The rebirth of interest in the exciting sport is credited largely to the development of new polyurethane wheels. Earlier steel and clay wheels slipped, skidded and jammed against obstructions, often causing serious injuries. New polyurethane wheels (lower left) are soft, rubbery and semitransparent. Their pliability gives them tremendous traction and allows them to roll easily over obstructions, making possible safer, yet even more hair-raising, maneuvers, \$10 to \$50 at sport shops.

Handy carry-all

All-purpose shoulder bag is handy for shopping, cycling, toting beach, picnic and camping supplies. Made of tough denim with Popular Mechanics imprint, it comes in traditional blue with white or yellow letters or natural with black or red letters. \$3.95 ppd., Popular Mechanics Carry-All, Box 1014, Radio City Station, New York, N.Y. 10019.

Plastic plant stand

Plant shelves of clear plastic let in sunlight and air for good growth. Starter set includes base and one 9-inch shelf, is \$14.95 ppd. Additional shelves can be stacked as desired. Dawn Enterprises, Box 3016, New York, N.Y. 10001.



Your fuel-injection system: How it works

by Paul Weissler

Once-costly, fuel injection has reached a degree of simplicity to make it standard equipment on an increasing number of cars—more than a dozen makes so far. It's not as simple as a basic one-barrel carburetor, but alongside a modern four-barrel, it doesn't look too complex.

Whatever the design of the fuel-injection (F.I.) system, the object is the same: to spray fuel through an injector nozzle into the intake port for each cylinder. Unlike most carbureted engines, in which cylinders closer to the carburetor get a much richer mixture, F.I. supplies equal fuel to each cylinder. The intake manifold remains with F.I., but instead of an air-fuel mix, it carries only air, which does not mix with the fuel until it reaches the intake port.

Electronic fuel injection (E.F.I.)

The electronic system features a small computer that draws information pertaining to fuel needs from engine sensors and opens the fuel injectors for as long as necessary to meet engine needs. There are three major subsystems: fuel delivery, air, and the computer and its sensors.

Fuel delivery

Fuel is drawn from the tank by an electric pump (turned on by a relay). It goes directly to the fuel-distribution manifold (or fuel rail, as it's sometimes called). On some cars there are two pumps, one in the gas tank and a second somewhere in the line before the fuel-distribution manifold. The first pump merely transfers fuel to the second, which builds up necessary pressure in the fuel-distribution manifold.

The squirt end of each injector is in the intake manifold, aimed at the intake port. At the other end is a neck that is a simple push-fit into the fuel-distribution manifold (with a rubber ring to seal against leakage).

The injector contains a needle-valve assembly operated by a solenoid switch wired to the computer. When the computer supplies current to the solenoid, it kicks in, pulling the needle valve off its seat, permitting gasoline under pressure in the fuel-distribution manifold to flow through the injector and be sprayed into the intake port. When the computer

shuts off the current, a spring pushes the solenoid back, reseating the needle valve and stopping the spray of fuel. Internal or external resistors may be used at the injectors to insure they receive only the three volts on which they're designed to operate.

Air system

The air system looks almost the same as on a carbureted car—there's an intake manifold and a carburetor-like part with a throttle plate mounted on top of the manifold. The major difference is that this part, called an intake air distributor, has no fuel to dispense. Only air flows through. Built into the intake air distributor is a device called an auxiliary air regulator on imports, a fast-idle valve on Cadillac. It's a thermostatic valve that opens when the engine is cold to admit extra air (and with the extra fuel injected, cold-engine idle speed is raised). Ignition current warms the air regulator's heating element to close the valve as the engine nears operating temperature.

Computer and sensors

An engine's fuel requirements vary with engine speed, temperature, load and rate of throttle opening (acceleration). Fuel supplied to the cylinders is varied when the computer supplies current to the injector solenoids for a longer or shorter time, based on information from sensing devices on the engine.

■ **Engine speed.** The computer trans-

lates electrical pulses from the ignition circuit into an engine-speed figure.

■ **Engine temperature and intake air temperature.** Sensing devices that pass current in proportion to temperature are threaded into the intake air distributor and water jacket (or into cylinder head on air-cooled cars). Current flow through each sensor gives a temperature signal to the computer.

■ **Throttle opening.** A switch is mounted on the intake air distributor at the throttle plate and the throttle-plate shaft is keyed into a movable pointer. As the throttle opens, the pointer moves from one switch contact to another or varies current flow through a transistorized circuit. Either way, the switch may be used for something as simple as a full-throttle sensor, or if necessary, to signal the computer that the throttle is being opened rapidly (such as on heavy acceleration), or perhaps is being snapped closed on deceleration. The computer would increase fuel spray on acceleration, cut it off on deceleration.

■ **Air flow through the intake air distributor.** A spring-loaded flap is positioned above the throttle plate. As the throttle is opened, inrushing air pushes the flap in, and the flap shaft, like the throttle-plate shaft, operates a pointer on a switch to provide an electrical signal proportional to airflow to the computer. All Beetles and many Porsche 914

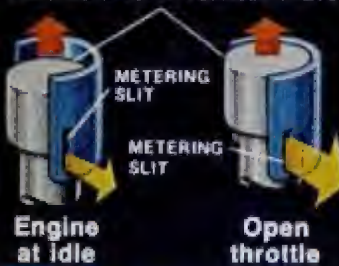


Fuel injection—how it squirts

(Continuous Injection System—C.I.S.)

Detail A

FUEL-DISTRIBUTOR PLUNGER VALVE



FUEL TANK

CONTROL-PRESSURE REGULATOR (WARM-RUNNING COMPENSATION)

CONTROL-PRESSURE REGULATOR (THROTTLE-POSITION COMPENSATION)

INJECTOR

COLD-START INJECTOR

FUEL LINES TO INJECTORS

FUEL-DISTRIBUTOR

FUEL PUMP

ACCUMULATOR

FUEL FILTER

INTAKE PORT

SPARKPLUG

INTAKE VALVE

INTAKE AIR DISTRIBUTOR AND INTAKE MANIFOLD SECTION

INTAKE AIR

AIRFLOW SENSOR

THROTTLE VALVE

Airflow sensor and fuel distributor details

AIR TO INTAKE MANIFOLD

FUEL TO INJECTORS

PLUNGER VALVE SEE DETAIL A

FUEL UNDER PRESSURE

BALANCE WEIGHT

Open throttle

INTAKE AIR

METERING SLIT

METERING SLIT

FUEL UNDER PRESSURE

AIRFLOW-SENSOR PLATE

PIVOT

Engine at idle

Push your foot down on the accelerator pedal and the same thing happens that happens in a carburetor: a throttle valve opens. However, only air rushes into the intake manifold. Fuel is squirted in at the intake port through the fuel injector. Fuel is metered to the injector in each cylinder in an amount determined by the position of the airflow-sensor plate which lifts as airflow to the engine increases. When the airflow-sensor plate lifts, it lifts the plunger valve in the fuel distributor. When the plunger lifts, it uncovers more of the metering slits (Detail A), allowing more fuel to flow through the fuel lines to the injectors.

cars with electronic F.I. use the air-flow sensor.

■ **Manifold-pressure sensor.** We normally think in terms of manifold vacuum, but this sensor measures absolute air pressure instead, because it's simpler to correct for altitude. An altitude-sensitive (barometric) bellows measures air pressure in the intake manifold and expands and contracts both according to altitude and manifold pressure changes.

The bellows' expansions and contractions move an iron core shaft nearer or farther from a coil winding. The computer sends a small current through a second coil, setting up a magnetic field around the iron core, and as the core moves toward and away from the first coil, it induces a varying current in it. This current is proportional to manifold pressure changes and provides a manifold-pressure signal as an engine-load indication to the computer.

A pressure sensor is found on Cosworth Vega, Cadillac, VW fastback and squareback, and some current Porsche 914s instead of an airflow sensor. A full-throttle heavy-load signal may be generated in part by adding a diaphragm-actuated pressure switch that closes when vacuum is near zero.

Choke

There is no choke to enrich the mixture for cold starting with F.I. Most imports have another injector just below the throttle plate to supply extra fuel for cold starts. Typically, the injector is turned on by a relay activated by the computer if

ambient temperature is very low and the engine is being cranked. Cadillac has found no need for the device on its F.I. cars.

Triggering the injectors

As many as four injectors are triggered simultaneously by ignition circuit break signals. If the carmaker wants to turn on only half the injectors at once, a separate trigger is used, such as a special set of breaker points or a switch in the distributor base. One cylinder uses the fuel immediately because the intake valve is open; the others store it in the intake port for an instant until their pistons are ready to begin an intake stroke.

VW fastback and squareback and some Porsche 914s, which had the trigger points, energize only two injectors simultaneously. Cadillac, using transistorized circuitry and the switch in the distributor base, activates four of eight at once. The fraction-of-a-second fuel storage might seem to pose problems, but tests show no improvements with individual injector triggering.

Continuous injection system (C.I.S.)

A simpler, less-expensive system is commonly called "continuous injection" because fuel can flow continuously through the injector, which effectively is always open. There is no computer, no triggering, but there are mechanical fuel-flow controls.

Like the electronic system, C.I.S. has a relay-activated electric fuel pump, but it delivers the fuel to a component called the fuel distributor.

This has a fuel-metering valve inside and a fuel line connected to each injector. Between pump and fuel distributor are a filter and an accumulator—a spring-loaded diaphragm device that acts as a pressurized reservoir to prevent vapor lock on hot restarts, and as a fuel-surge damper on normal restarts.

As with E.F.I., the injector is in the intake manifold, aimed at the intake port, and because the fuel flow is virtually continuous, each port always is storing fuel for the next intake stroke.

The key part of the fuel distributor is the metering or plunger valve which moves up and down in a cylinder with slits, each slit opening to a chamber supplying one injector. When this valve moves up, it uncovers a greater part of each slit, permitting more fuel to flow through. When pushed down, it covers more of each slit and fuel flow is reduced. The basic fuel-flow controls are devices that create an upward or downward push on the plunger valve.

The C.I.S. airflow sensor has a plate inside attached to a lever arm and balance weight. As airflow increases, the plate pushes up the lever arm on the plunger valve to increase fuel flow.

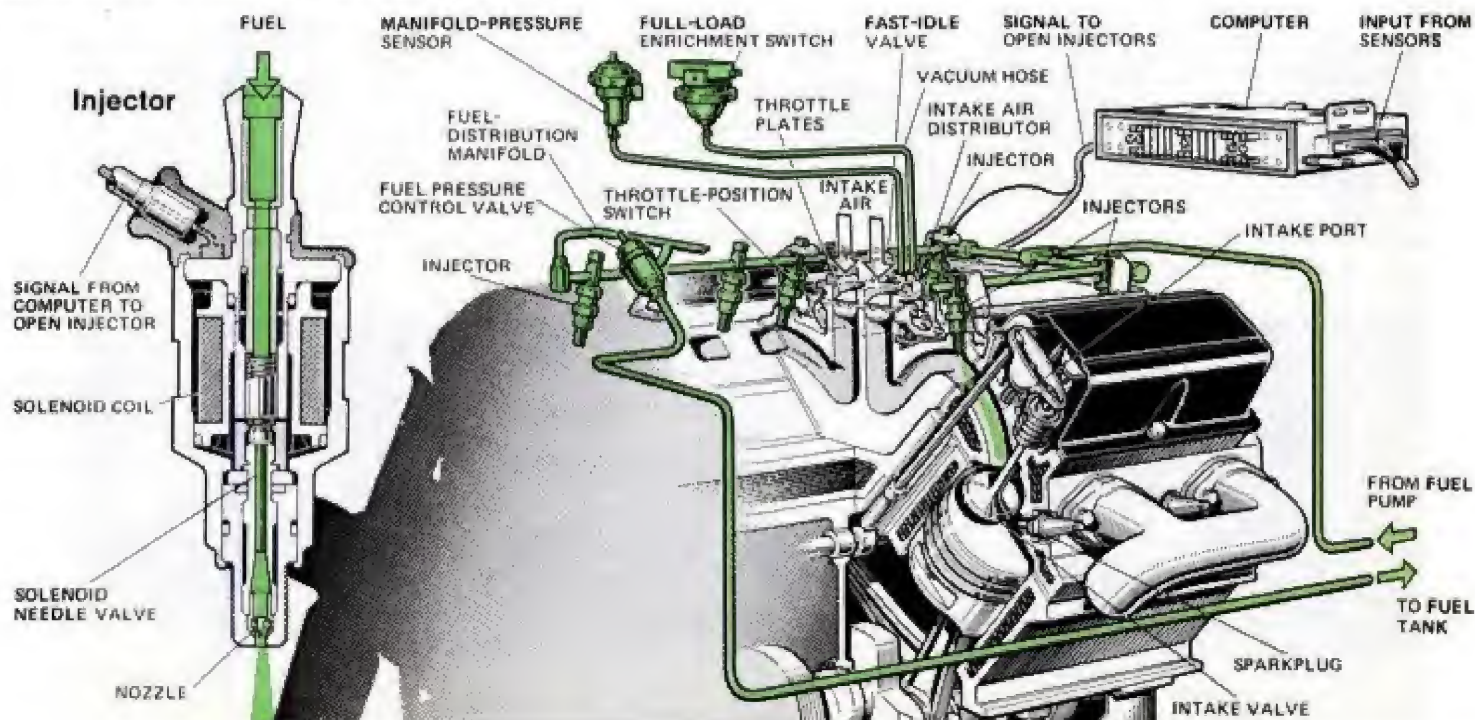
Warm-running compensator

A warm engine can run on a leaner

(Please turn to page 144)

At the heart of an electronic fuel injection system is the computer that triggers the solenoid-operated needle valves in the injectors (see text).

Electronic fuel injection (E.F.I.)



How to keep your fuel-injection system working smoothly

by Paul Weissler

Servicing fuel injection is not as scary as you might think. If you can use a test lamp, voltmeter, ohmmeter and pressure gauge, and have simple remove-and-replace skills, fuel-injection service is easy.

The most important thing to remember is that fuel injection (F.I.) is the last item to check when you have a starting or performance problem. The most likely causes still are in such prosaic items as battery, cables, ignition, compression and timing.

Electronic F. I. (E.F.I.)

Sure there's a computer, but it's extremely reliable (no moving parts) and even most professionals couldn't check it out directly. As with any computer-controlled system, your approach is to see if the computer responds properly to information from its sensors, and if it doesn't, replace

it. In any case, the computer is the last item to worry about.

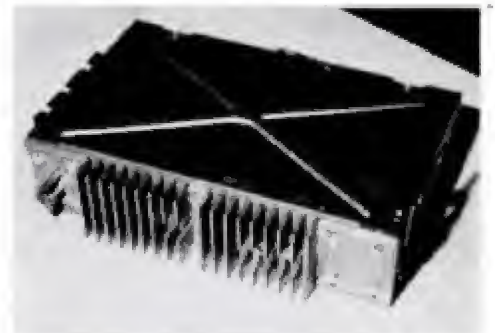
As with any fuel system, the first question is whether there's fuel delivery—in this case to the injectors. When you first crank the engine, the electric fuel pump should buzz audibly for one or two seconds. If it doesn't buzz, check the pump fuse and try again.

On cars with an airflow sensor, the pump normally is turned on by a contact in the sensor shaft switch on the intake-air distributor. Remove the air cleaner duct and check the sensor flap for reasonably free movement. A light balance spring keeps the flap in the closed position with the engine off, but hand pressure easily overcomes it.

If the sensor is stuck closed and breaking it loose gets the pump working, free up the flap assembly with solvent. If the sensor is free,

but the pump suddenly starts working only when you push the flap in and turn on the ignition, the flap shaft switch is defective.

The simple check of the sensor flap for free movement also should be made if general engine response is poor.



Electronic fuel-injection computer on Cadillac Seville is under the dash.



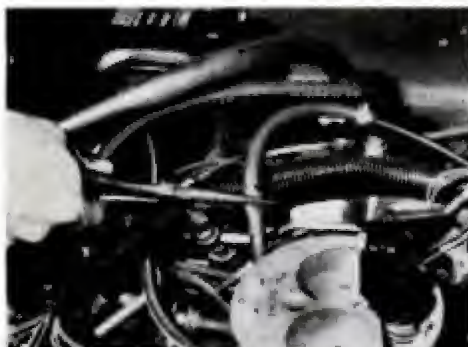
Remove valve cap from fuel-distribution manifold, push valve in, look for squirt.



Pressure gauge is connected to the valve to take a reading of fuel-system pressure.



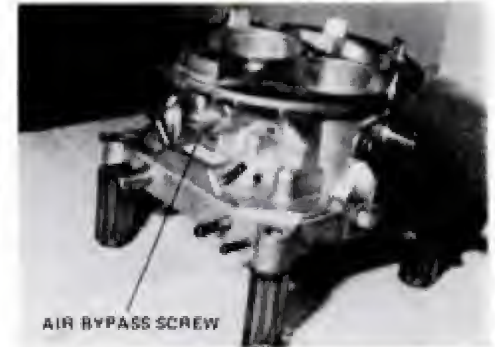
Temperature sensor is disconnected (giving computer a "hot engine" signal).



Vacuum hose to pressure sensor is pinched (may make engine load up, stall).



Fuel injector inserts in fuel-distribution manifold and is wired to computer.



Air-bypass screw location is shown here on the intake air distributor.

At the injection manifold

If the pump turns on, the next step is to check for fuel at the fuel-distribution manifold. On the Cadillac Seville, this is simple: Just remove the cap on a Schrader-type valve, pack an absorbent cloth around and push in the valve as if you were deflating a tire. If plenty of fuel squirts out, you can assume the fuel-delivery system is working. For exact pressure, hook up a gauge. You should get a 39-pound-per-square-inch reading with the engine cranking.

Most E.F.I. systems on imported cars have no Schrader valve, although some VWs were built with a plug-covered tap in the fuel-distribution manifold. You can loosen the plug and check for a fuel squirt, but be ready with the cloth because it will be messy. The same is true if the only choice is to disconnect the fuel line to the fuel-distribution manifold to see if fuel squirts out.

Once the line is off or the plug is out, you can tee in a pressure gauge, crank the engine and look for a reading of 28 p.s.i. on VW, 30 p.s.i. on most other imports. Minor deviations may be caused by a partly plugged gas filter or improper adjustment of a fuel-distribution manifold fuel-pressure regulator. The regulator is set manually on all manifold-pressure sensor systems except Cadillac, by turning an adjusting screw on top.

If you get little or no fuel flow on a very cold day, water droplets in the fuel may well have frozen in the gas filter, plugging it. Heat the filter housing with warm air. A hair dryer is a good source.

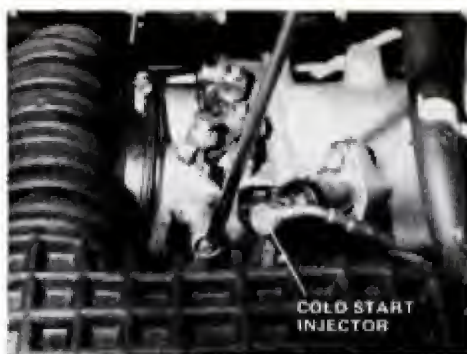
Electrical

If there's apparently adequate fuel to the fuel-distribution manifold and the engine still won't start, the next step is to check the temperature sensors. On a cold day it's possible that the sensors are signaling "hot," and the engine is starving for fuel.

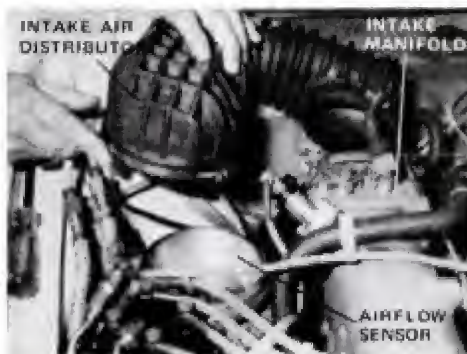
The coolant-temperature sensor (or engine metal temperature sensor on air-cooled VWs) is the one that provides the strongest signal. It's threaded into the water jacket or radiator (into the head at No. 4 cylinder on air-cooled VWs). To check it, proceed as follows:

Imports: Low sensor resistance signals hot engine; high resistance, cold engine. If there are two terminals in the connector, join them with a jumper to try to restart a hot engine; leave the connector off and dangling to attempt to get a balky cold engine running. If there's one terminal, ground it with a jumper for a hot engine; leave the connector off for a cold engine.

Cadillac Seville: Low sensor re-



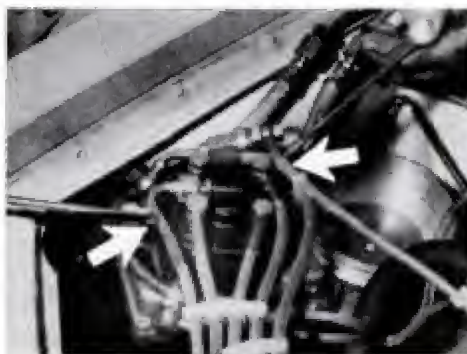
Continuous-injection system: Tool points to the air-bypass screw on airflow sensor.



Air duct is removed from the airflow sensor for access to the sensor plate.



Airflow sensor plate is pushed up (air cleaner is removed for access).



Pressure can be checked with ordinary gauge, but two connections must be made.

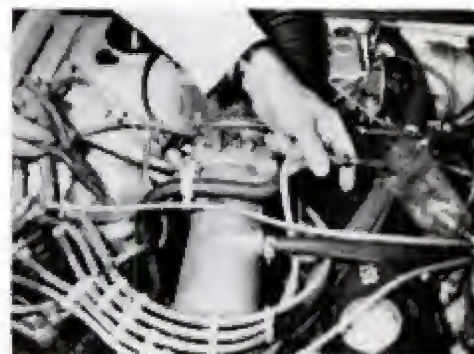
sistance signals cold engine; high resistance, warm engine. The connector has two terminals. Join the terminals on a cold engine; let the connector hang free on a hot engine.

Cold-start injector

Imports have an additional injector in the intake-air distributor to assist starting on a cold day. The



Airflow sensor switch is disconnected for checking the system.



Airflow sensor plate is lifted to check injectors (one is squirting into container).



Pressure and counterpressure are checked with special gauge and shutoff valve.



Allen wrench is inserted in airflow sensor, adjusted to lower carbon monoxide.

injector is controlled by a temperature-sensitive time switch, which means it will inject longer at lower temperature. The simplest check, although not necessarily the fastest, is to remove the injector, aim it into a container, crank the engine and see if the injector sprays.

If it doesn't, the problem normally

(Please turn to page 146)



Sleek touring ski (left) for newly popular cross-country, can be trimmed from old Alpine (right) using same bindings.



Cutting guide for narrowing skis is provided by rabbit slot where metal edgings have been removed. Trim cuts ski weight.



Rough saw cut is smoothed off with block plane to reshape tip and achieve straight right-angle edges with bottom ski surface.

Slim those old skis for cross-country

by Philip Hermann



Bottoms are cleaned with sharp furniture scraper until all old wax, base and varnish are removed. Coin edge cleans groove.



New and old tips show handsome slimming and streamlining (left) of recycled ski. Filing makes sharp bottom edge, round top.



Pine tar, a wood sealer and wax base known as Grundvalla, is applied to bottom with small brush, burned in with propane torch.

Those old wooden skis gathering dust in a closet can be recycled into handsome and useful cross-country touring skis for a few dollars.

Old downhill skis weigh as much as 12 pounds a pair, averaging about 82 inches (210 cm) in length and nearly three inches (70 mm) in width, much too wide and heavy for a long hike over the snow. It's not difficult, however, to remove weight while retaining the original length and strength. New cross-country skis vary from the ultralight 3-pound, 2-inch-wide (50-mm) racing pairs up to the 7-pound, 2½-inch (65-mm) models. After refinishing a pair of your old downhills, they should fall roughly into the category of a general touring ski.

First customizing step is to strip the old skis of all metal edges and bindings. Save these for future use. The rabbit groove where the steel edge is removed is an excellent guide for sawing off unneeded wood. This trimming will reduce the ski width by about ½ inch or 12.7 mm. The combined removal of steel edges, screws, and excess wood can save as much as two pounds per ski.

The rough-sawn edges can now be smoothed and the tips reformed with a block plane. A 10-inch double-cut file will smooth out any abrasions left on the edges. This final filing also helps form sharp edges along the sole of the ski and a rounded edge on the top. Layers of wax, varnish or paint can be removed with a cabinet scraper, and the groove in the bottom of the ski scraped clean with a coin. Follow the scraping with thorough sanding with No. 50 sandpaper, then No. 120 paper.

Grundvalla, often called pine tar at ski shops, is next applied as sealer and base before you wax ski soles. Brush a thin, even coat on each ski bottom. It will penetrate as a propane torch flame is passed over the surface until the tar bubbles and dries. Keep torch in motion so no wood is singed. Rub with a rag after burning in the tar, and remove any warm excess tar.

Stain the ski tops if a darker color is desired, then finish with two coats of clear polyurethane. Your old cable "bear trap" bindings clean up easily with naval jelly and work quite well with old flexible boots. For walking, run the cables through the front heel clips instead of the rear ones to give more freedom of movement. Your old binding heel plate will probably be too wide, but a pair of new touring plates cost only about \$1.

You'll need longer poles than for Alpine skiing. Cane or bamboo are less expensive. Then wax up according to snow conditions. You're ready for cross-country touring. ★★



Bob Sparks makes last-minute preparations (above) aboard gondola, a seaworthy, 14½-foot aluminum boat that now has survived two ocean splash-downs. Lift-off (right) came at 1:02 a.m. on Aug. 21. Flight was aborted 18 hours later because balloon was losing gas.

Photos: W. A. Allen



That transatlantic balloon jinx strikes again!

by Paul Wahl

Unexpected hitchhiker

Hitching a balloon ride, Sparks's crew chief clings to a rope beneath the gondola as the 92-foot-high balloon soars skyward. It was no accident: Hadden Wood secretly planned it that way. Sparks worked for an hour to get his stowaway crew chief aboard.



Floodlighted against the midnight sky, the mammoth balloon *Odyssey* loomed high as a 10-story building above the golf course at the New Seabury Country Club on Cape Cod. After waiting seven weeks for the right weather, aeronaut Bob Sparks was on board and ready to take off on his second solo try at ballooning across the Atlantic. In August 1973, 850 miles into a transatlantic flight, Sparks's *Yankee Zephyr* was forced down by a freak thunderstorm off Newfoundland.

Nobody has ever flown a balloon to Europe, although it has been feasible for more than a century. Of the 13 balloons previously prepared for this voyage (the earliest in 1859), only seven ever got under way on the ocean flight. Some mishap befell each one. Since 1970, five balloonists have died trying to beat the *Transatlantic Balloon Jinx* (cover story, June '75 PM).

At 1:02 a.m. on Aug. 21, 1975, Bob Sparks commanded "Hands off!" and his ground crew turned the *Odyssey* loose. As the giant craft soared skyward, events took a bizarre turn. Suddenly, the cheers of the crowd changed to cries of horror. Below the gondola, a man was dangling from a rope! This proved to be no accident—the passenger was Sparks's crew chief Hadden Wood, who had secretly prepared to join the flight in this way.

A grueling hour to get the stowaway aboard

Now, with his long cherished hope for a solo flight dashed, Bob Sparks faced the problem of getting the stowaway safely aboard. Wood was clinging to a 30-foot line secured on the starboard side of the gondola, near the bow. Wearing a harness he had hooked to the rope, he was standing in a loop at the end of that line. Using a winch at the gondola's stern, Sparks lowered a weighted line and swung it toward Wood for him to grab. A grueling hour later, Sparks had managed to get the line to Wood and hauled him aboard.

After this bad start, things got worse. Warmed by the sun, helium in a balloon expands and lift increases. When the *Odyssey* didn't climb as expected, Bob Sparks realized gas was slowly leaking from the envelope. Shortly after noon, he radioed flight director Harden Crawford that, while the balloon could stay aloft 10 or 12 hours more without danger, the flight would have to be aborted.

(Please turn to page 166)

Your tools— one of the best investments you'll ever make

Today's tools offer the financial advantages of high-quality investments. An expert tells why, and how you can get maximum return on your tool dollars.

by David Warren

Photos by the author

It's possible that you've never looked at your home workshop from an investment point of view. And it's just as possible, especially if you don't own stocks, that you've never thought of yourself as an investor. But the tools you own and the ones you'll buy in the future actually represent an investment that will both preserve your capital over the years and produce whopping "dividends" every year.

As a do-it-yourselfer, you have an edge over the ordinary investor—because you are a producer as well, and your tools are the capital that makes you productive. Other investors let the money do all the work, and they just can't get the kind of return that you can with a busy home workshop.

Ray Franz of Gary, Ind., a former postal worker who retired seven years ago, recently sold most of his tools after decades of active do-it-yourself work. "Just keeping those I'll need in the motorhome," he said. He and his wife, Helen, are selling their house and buying a condominium so they'll be free to do more traveling in their RV.

When I talked to Ray, he was pricing his tools, at 40 to 60 percent of current value, and expected to sell them quickly. "Six months ago," he said, "I sold several hundred dollars'

worth of tools in a weekend." Helen noted, "Any tools that Ray bought before the Korean War sold for more than he paid. In fact, his 15-in. drill press he bought used decades ago sold for three times our cost."

To prepare for the next sale, Ray and Helen were putting small labels on each tool and accessory, then marking prices on them based on current catalogs and price lists.

He got his asking price

Ray got his price for nearly all of the items, because he had always bought quality tools and taken meticulous care of them. Most were in mint condition when sold.

The Franzes' house was among the highest-valued in their neighborhood, because of careful maintenance and a number of improvements. Ray re-

modeled the kitchen twice during their 46 years there, finished the basement, paneled the den and added many built-ins. Over the years he crafted furniture for the house and, later, for his children's homes. "Just finished a Danish modern walnut bedstead for Marge, my granddaughter, who's getting married next month. Furniture for three generations out of those tools."

Ray was asked if he could estimate the dollar payoff from his tools. Knowing their resale value today, that was easy. "We got two bids for remodeling the porch," Helen recalled. "By closing in the porch himself, Ray probably recovered more than his total tool investment." And that from only one of many major improvements Ray made over the years, not to mention the savings he



accumulated doing maintenance work and furniture building.

The overlooked investment

Few think of home-workshop tools as an important base when planning an overall family investment program. That's partly because financial advisers don't often work with their hands. Nor are tools considered a glamor investment in which the rich can make a killing. So the value of tools as a basic investment is usually overlooked. Not everyone can afford to buy gold mining shares or open a Swiss bank account. But just about all of us can afford to invest in tools, especially to weather the economic storms we have in these times of inflation. For those who have the skill—or a desire to gain it—the worse economic conditions get, the more compelling a do-it-yourself tool investment becomes in helping to provide what a family needs.

While tools might be a tiny part of a wealthy investor's portfolio, they can be a healthy chunk of any ordinary guy's net worth.

Investing differs from short-term speculation and trading. When investing, you purchase goods with the intention of retaining them as long-term assets in the belief that they will increase in relative value or provide a generous income, or both. An investor tries to attain these objectives with a minimum of risk to his investment capital.

Besides safety of capital, the objectives of an investor can be spelled out as a hedge against inflation or deflation, dividend or interest income and liquidity or salability. We'll see how tools satisfy each of these investment objectives.

Safety of capital

This is the primary objective for any investment—preserving value. Avoiding or reducing the chance of losing your capital is more important than a large capital gain.

Tools, which are known as "hard assets," are never subject to total worthlessness—as any legal promise to pay can be. This happened to Germany's paper money after World War I, and certain blue-chip stocks, gilt-edge bonds and other types of savings have also become worthless. Even the cash-surrender values of life-insurance policies, in an inflationary period, do not retain relative value as well as good tools. If you purchased \$1000 of basic sta-

tionary tools in 1960, the replacement cost today would be about \$1500 or \$1600. Their resale value would be about \$700 to \$950. Since 1960, the purchasing power of \$1000 has fallen to about \$750.

A poor-man's tax shelter

A tool collection can be considered a poor-man's tax shelter. Usually there is just one tax on tools—sales tax paid on purchase. Often, there is no tax liability on the products of your own efforts around your home (and when they do affect your assessed valuation and thus your taxes, they also increase market value and the value of your equity). Your tool investment cannot be eroded by taxes, since it is not subject to recurring taxation as is real estate (only when you sell your tools does their return become taxable income).

Tools have never had to be sold to the government as a patriotic duty in times of major financial crisis. This did happen to personal holdings of gold bullion in 1933 during the reorganization of our monetary system. Instead, tools plus know-how are the basis of a nation's productivity, its fundamental resource.

Keep an inventory

Maintain a list, or a photographic record, or both, of all your tools. Keep this inventory with your insurance policies in a safe-deposit box. Periodically check the adequacy of your insurance protection against fire and theft. It's usually included as part of your homeowner's policy. Increase the value of your insurance protection as the size of your tool collection grows and as inflation raises replacement costs.

Major power tools have enough sheer weight per dollar of value to make them less subject to thievery than other valuables. Misplacement of small tools is a greater threat to capital safety. The best defense is to build the habit of putting each tool back in its proper place—daily.

Sharing hand tools and portable electric tools with friends is one way to minimize total tool investment per dollar of return. But if you lend a tool out, put a slip of paper in its place showing the borrower's name and the date lent. Don't assume you—and he—won't forget. Additionally, you may wish to engrave your name on your tools for protection against both theft and those accidental permanent loans.

Hedge against inflation

Tools are a hedge against serious inflation and deflation. Resale price is usually 25 to 60 percent of current retail price for a particular tool,

depending, among other things, on its quality, condition and usefulness.

Historically, tools have kept up with inflationary price increases, but resist drastic deflationary price reductions. That's one reason why the bankruptcy rate for hardware stores is one of the lowest for small businesses.

Over the long term, the primary trend has been inflationary. Even during the depths of the 1929-1933 depression, new-tool prices were higher than they had been 20 to 30 years earlier. Prices of a 10-point crosscut hand saw offer a good example:

1900	\$1.05
1910	1.26
1920	2.35
1930	2.20
1940	2.85
1950	4.19
1960	4.98
1970	5.39
1975	8.99

Another example is the history of prices of a typical C-clamp over the past 35 years:

1940	\$.90
1950	1.78
1960	2.46
1970	3.80
1975	4.65

As a hard asset, tools should not be sold if hyperinflation occurs. The last thing you'll want then is the fast-depreciating paper dollar, unless you need to use the proceeds to pay off debts or current obligations. If possible, liquidate only after inflation has been brought under control.

Invest in quality

If you have a choice when buying tools, always opt for the best. Be satisfied with nothing less. When you buy quality, you are getting good engineering, finely tempered steel, availability of repair parts, adjustability at points of wear, resharpening capability—and, above all, long life.

Quality brings shop safety, workability, versatility and preservation of your invested capital. Junk tools are unsafe, make good work difficult, and resell for little.

The principal problem with buying used tools is that really fine ones are rarely sold. So bridle your impulses and be picky about what you buy at garage sales.

Acquisition strategy

Acquire a tool only as you need it. Then you can recover some or all of your investment immediately. Don't buy an oil-filter wrench in case you decide to start changing your own oil. Wait until you buy filter and oil;

Many of David Warren's workshop projects have appeared in these pages, as has his shop (*The Shop That Became a Family Fun Center*, page 88, March '75). He is a senior systems analyst for Commonwealth Edison Co., Illinois, involved in analysis and evaluation of economic alternatives.



Well-made tools preserve your capital because they're engineered to last. Allowance for adjustment at points of wear makes for long life. Turning the gib screws on this jointer will take up any wear in the dovetail ways on which the tables slide. Because of these adjustments, this old tool shouldn't wear out in 50 more years of home use. Made about 35 years ago, it retailed for around \$185. I bought it used and rusty for \$50 in 1968—and probably could resell it today for about \$170. During that period, the same \$50 put into a savings account instead would have appreciated to only about \$75.

then buy the wrench. It costs about \$1.30. You'll more than recover your investment right away. And you may even spend less time on the job than it takes to drive to the service station and have it done. Each time you use the wrench, you'll get another generous dividend on your investment—the annual yield should be at least 200 percent.

If there is a single best approach or financial strategy for successful investing in tools, it is to take time to develop a shopping list of equipment you need in order of priority. By preparing your list logically, with detachment and thought, and emphasizing *need*, you're less apt to be suckered into impulse buying.

When a neighbor of mine saw a complete set of auto wrenches on sale, he thought it would be a good idea to own them. So he paid the \$49. "After all, I did save \$10 over the regular price," he told his surprised wife. Fine, but he never did any auto-repair work before—or after. You can't make a decent buck in tools that way.

As you work on your long-term shopping list, arrange it to give high priority to achieving maximum versatility. If you can do a really wide variety of do-it-yourself jobs, you can skim off the cream of potential savings. Then add tools to give greatest versatility within a type of work. If, for example, you already have a 1-in. wood bit, it may be better to buy a 1½-in. bit instead of another

type of 1-in. bit. Or buy an expansion bit. Similarly, when you're starting a collection, or your budget is limited, it may be better to buy a variety of hand tools and portable electric tools rather than one major stationary tool such as a table saw. Put quality hand tools at the top of your list.

When preparing your list, evaluate the probable versatility of and return from each tool. This will help set priorities on your investment buying. Then you can start adding specialized tools in a favorite area, such as woodworking or auto repair. Consider speed, labor savings and quality work.

When and where to buy

Use your "priority list" of basic tools to buy when appropriate tools are found on special sale or available used. Discontinued models and floor samples can be fine opportunities. Don't overlook pawnshops as a source, and remember that pawnshop prices may be negotiable.

If, on the other hand, you need an unusual tool, such as a forstner bit, for a particular project, wait until the week you'll actually use it. Sometimes it's good business to rent expensive tools, such as floor sanders, that are so specialized you'll need them only rarely.

Take advantage of seasonality in tool sales. One good time to buy is in the early fall. Another, surprisingly, is around Christmas, when hardware dealers are offering specials to attract gift-buying dollars. For the used market, a good time is in the spring—income-tax season.

As you acquire a tool, take time to learn all about it. There's skill involved even in using a hammer properly. Learn to use the tool safely.

Treat your workshop space as an investment, too. Don't go to the extreme of a beautiful shop that produces nothing, or its opposite, a dingy, cluttered area that is unpleasant to work in. Strike a balance: As your shop produces, occasionally spend some time and money on work areas, storage facilities and lighting. A comfortable, cheerful shop can contribute to more and better projects.

Using credit

In financial circles, the term "leverage" refers to the use of borrowed money to make investments—which may become speculative because the leveraging effect can greatly multiply the profit or loss on an investment.

A form of leveraging is available to you as an investor in tools—it's the use of your consumer credit to make purchases to put your skills to work. You're using credit the right

way when you can borrow for a purpose and save much more than the cost of interest.

A tool investment made on credit should be scrutinized even more carefully than those you make with cash, since it *has* to produce a solid return to offset the cost of borrowing. You should apply all the rules of prudent consumerism when using your credit, whether by means of a revolving charge account, bank credit card or bank loan. Be sure you can repay and be sure you know the true annual interest rate you'll be charged.

Dividends from tools

When you buy a company's stock, you buy its earning power: buildings, tools and an organization of skilled people. When you buy tools, you buy earning power in your own



Reliable manufacturers can supply repair parts when you need them, even decades after a tool's original purchase. The bearings of my lathe became worn after years of faithful service; a new set was acquired quickly and installed easily, renewing the machine completely. This 12-in. lathe, which was made in 1952, originally sold for about \$195 with motor and stand. Its resale price at the present time would be in the neighborhood of \$225.

maintenance, repair and construction business, capable of doing anything from simple furniture repairs to a major room addition or reproductions of antique furniture—your dividends.

You have direct control over the size of the dividend yield. And returns can begin immediately—buying a new tool for the job at hand does that. Once you own the tools, knowledge and application are all that are required to obtain dividends. That knowledge is readily available from *PM* and books, from tool and materials manufacturers, from friends and helpful sales people.

Dividends from tools make a positive contribution to your budget for home maintenance and improvements, furniture, gifts and, not to



Keep your tools in tip-top condition to preserve your investment. Take the few minutes necessary to buy replacements for broken or missing parts, like this 25-cent saw-handle screw. New handles and parts for most of the common hand tools are available at your hardware store.

be ignored, your own personal entertainment. Besides providing relaxation for you, tools also offer the chance to provide pleasure and creative activity for your children, while teaching them a sense of responsibility.

Cash dividends are also possible. I know one man who recommissioned a metal lathe and used it evenings and weekends turning out job work to supplement his income. It got him through the triple squeeze of a new mortgage, a new baby and a recession. Many men and women use their tools to supplement retirement income. Selling small items to local gift shops is typical.

To obtain *any* dividends from tools, you have to have guts and believe in yourself. You realize that you may have to do a new job twice to get it right once, but you know that the next time, you'll get it right the first time. Having tools and the skills that go with them can give you

a justified sense of security. And the products you make can be of higher quality than anything you could buy.

Tools provide "stock dividends," too, because you can use them to make more tools and jigs—a capital appreciation that carries no capital-gains tax liability.

Preserving and renewing

Every physical acquisition has a need for attention. Well maintained, most quality tools pay dividends for a lifetime or longer, and will preserve their relative value.

Use naval jelly to remove rust and protect cast iron and steel. I prefer wax as a general preservative for both metal and wood; it neither evaporates nor gets things dirty as oil and grease do. You can make an inexpensive wax solution by shredding paraffin and dissolving it in mineral spirits. Bottle it in a squirt container that liquid detergent came in.

Keep your tools sharpened, wiped clean and stored. If hung on a tool board, they can't nick one another sliding around in drawers—and rust and misplacements are readily apparent when tools are displayed. However you store them, a dehumidifier near your tools usually pays for itself by protecting your investment from mildew and rust. Don't rush to clean up sawdust and wood chips—they absorb moisture, too. But don't let them accumulate to the point where they become a fire hazard.

Back-up cash

Your tool investment needs cash backing for materials to produce healthy dividends. A liquid cash position, or capital flexibility, is the most frequently overlooked aspect of investment programs. Investors get overconcerned with "things" and neglect working capital. It's important not to tie up all your do-it-yourself funds in tools.

Properly made, investments are from surplus cash. Maintaining a liquid cash position protects you from

having to raid any long-term investment when you need cash in a hurry. Home shop tools, sensibly acquired, should not interfere with a reasonable overall cash position.

If you set aside funds regularly to back up your tool investment, you'll have ready cash to use to take advantage of unexpected opportunities to upgrade or buy a tool that will specifically increase the speed or quality of jobs you do. And with working capital, you'll be able to meet the week-to-week cost of materials and supplies.

During an inflationary period, increase the size of your cash reserve—because the purchasing power of your normal reserve is decreasing and because your need for capital flexibility is greater in a potentially precarious economy.

Liquidity and salability

Liquidation of your tool assets can be accomplished quickly in the used market through a low-cost classified ad, a flea market, garage sale or auction. Tools can also be swapped for other goods. In a real monetary crisis, luxury items like jewelry, precious metals and antiques may not hold up as investments as well as good tools.

When selling your tools, take time to put them in first-class condition. Tag each at 50 to 60 percent of the current market price. Then hang in there. Don't rush to accept the first offer if it's below your price. You can generally make more by pricing and selling the tools individually than by selling in groups or selling an entire collection to a single purchaser.

But selling a tool collection is probably in the far future for you. It's just good to know that it can be done, and profitably. Meanwhile, keep on investing and making your investment produce dividends. There's no such thing as complete security—there's only opportunity. There's no better investment opportunity than yourself and tools. ★ ★ ★



Carefully chosen, used tools are a good investment. This fine Buck Bros. cast-steel chisel was found at a flea market for 75 cents, renewed with naval jelly, buffing and an 80-cent plastic handle (the chisel's tang was heated, then forced into the handle). The total cost was but one-fourth to half the current price of a comparable chisel.

by Stephen Walton

ASSISTANT EDITOR, HOME AND SHOP

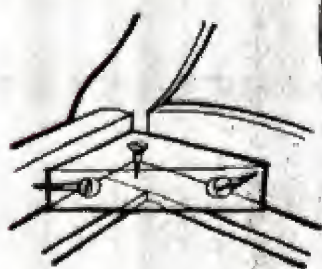


12 FIXUPS TO READY YOUR HOME FOR HOLIDAY HOSPITALITY



1 Tighten up wobbly furniture

You and your guests will want to sit comfortably—not in chairs that have the shakes. Chairs built with corner-block construction, like the one shown, may require no more than tightening the screws in the blocks. For other chairs, you can make corner blocks to hold those loose joints together—install them with white glue and screws. Note angled holes to let screws enter frame squarely. L-shaped or notched blocks can also be used.



Art: Robert Greenough

2



Fix sticking doors

Planing may be the only way to ease a binding door; clamping it to a wooden box is a good way to hold it—don't forget to cut hinge mortises back to original depth afterward. But you can try other remedies before you take the door down. If the bind is at the threshold, put coarse sandpaper there and swing the door over it. Loose hinges can make a door stick, so tighten hinge screws. If you find a free-turning screw in an enlarged hole, you can anchor it in a rolled-up scrap of metal toothpaste tube.

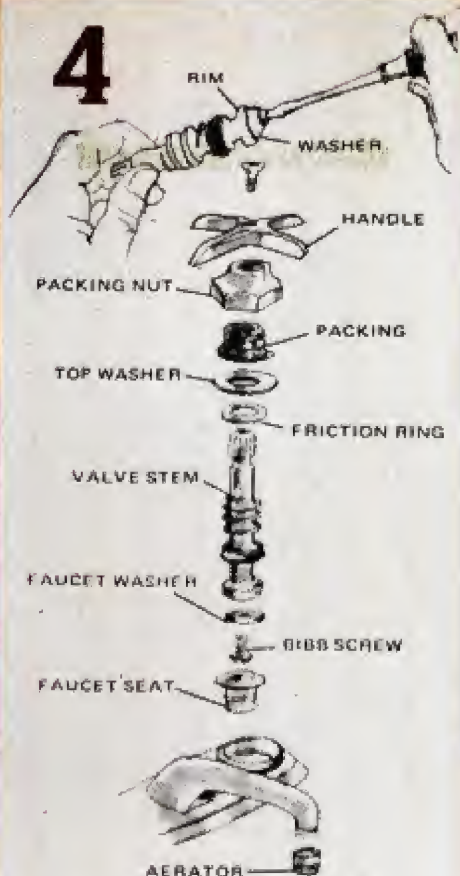
3



Put up a wainscot

Wainscoting is an attractive improvement—and a convenient coverup if the lower part of a wall is in bad shape. Kit type is easy to install with adhesive, nails, and clips between tongue-and-groove panels. The chair-rail molding at the top protects the wall from scrapes. For about \$40, the kit will do a 13-ft., 4-in. run. Panels are prefinished, offer four color/texture choices. Made by Marlite Paneling, Dover, Ohio 44622.

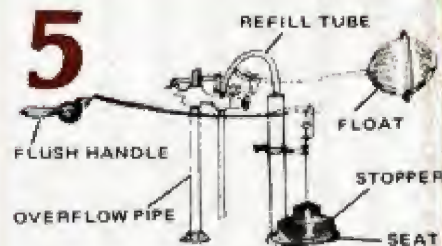
4



Stop that drip

Even if you're used to it, there's no reason to subject company to the torture of a dripping faucet, not when a new washer is usually all that's needed. A conventional compression-type faucet is easy enough to take apart—but don't use pliers on the ribbed upper end of the valve stem. Turn off the water supply to the faucet first, of course. If you damage that ribbing, you may later be able to turn the handle with no trouble at all, but it won't operate the faucet. If you hold the stem in a vise to remove the washer bibb screw, it should be a wood-padded type for the same reason. If you've replaced the washer and the faucet still leaks, the seat needs attention, since a rough or badly worn seat can let water past even a new washer. Your hardware store should have a valve-seat grinding tool—just follow the instructions that come with it. Don't overdo it, and remember to rinse the cuttings out before you reassemble the faucet. If the leak persists after you've dressed the seat this way, it's time for a new seat (if it's replaceable) or a new faucet. To replace a seat, use an inexpensive seat wrench and coat the new seat's thread with pipe compound.

5



Tend to the toilet

If water continues to trickle into a toilet bowl after flushing, it probably means that the rubber stopper in the tank assembly has become hard with age and isn't making an effective seal with the seat. Shut off the water supply to the tank before making any toilet repairs. If the stopper is okay, or replacement doesn't help, the seat itself may be corroded, and cleaning it with emery cloth may be the answer.

Replacement of both stopper and seat with a modern flapper-type valve may be necessary, or you may have a worn washer in the float-valve assembly. With an old toilet, replacement of the entire float-and-valve assembly with a modern ballcock (without the float and arm) is a good idea. Kits for that purpose are made by Fluidmaster, Inc., 1800 Via Burton, Box 4264, Anaheim, Calif. 92803.

6



Hide scratches

Blemishes (that's the trade term) on furniture—those small nicks and scratches—are easily dealt with. Just using a tinted polish on them may be enough. If that won't do it, use a touchup dress from your paint or hardware store. If you can't find one that's an exact color match, get two or more and blend them. Fill the scratch and rub well, then apply wax and rub that.

7

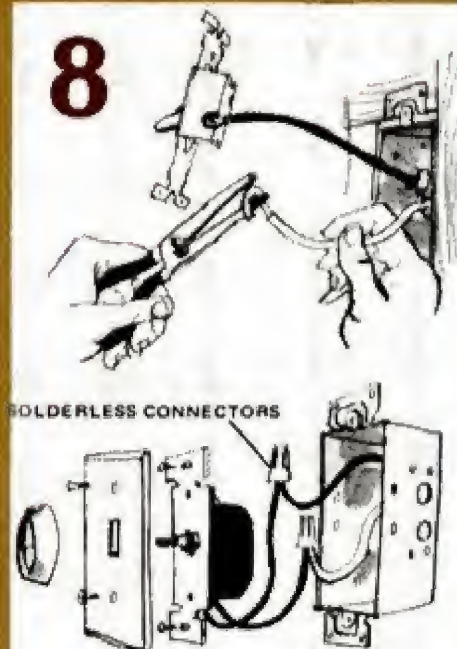


Fix ceramic tile

Loose ceramic tile in the bathroom doesn't just look bad—it can lead to water damage. First, be sure to find *all* the loose tiles or you won't really be doing the job—tap with your fist, but not too hard, since you want to be able to put the original tile back up. With the tile down, scrape the old mastic off with a putty knife; you may have to soften it with solvent. Get the old grout off the tile; most you can break away, some you may have to grind or file off. Then apply new adhesive to the wall—be sure it's dry—as in the top picture, and spread it out with a serrated trowel.

Press the tiles into place, aligning them with others and allowing for grout lines. Acrylic latex grout is easiest to use. Press it into joints with a fingertip. Wipe down gently with a barely dampened sponge, then let the grout dry overnight before you rub with a soft, dry towel to take the white film off tile surfaces. To make tile sparkle, use a good glass cleaner.

8



Replace light switches

This is the time to fix that light switch in the guest room that hasn't worked right in years. Turn off the circuit at the service panel by yanking the fuse or flipping the circuit breaker. Remove switchplate and the screws that hold the old switch. Then it's no more than a matter of loosening the terminal screws on the old switch to remove the wires and then connecting the new switch.

See that the bare wire ends have a curl that's clockwise when they're in place, so they'll remain secure as you tighten terminal screws. Coil the wires back into the box and screw the new switch into place, taking care to align it for free operation with the switchplate replaced. If this is a job you don't like to do too often, put in a mercury switch; besides the advantage of silence, they also offer service life of many years.

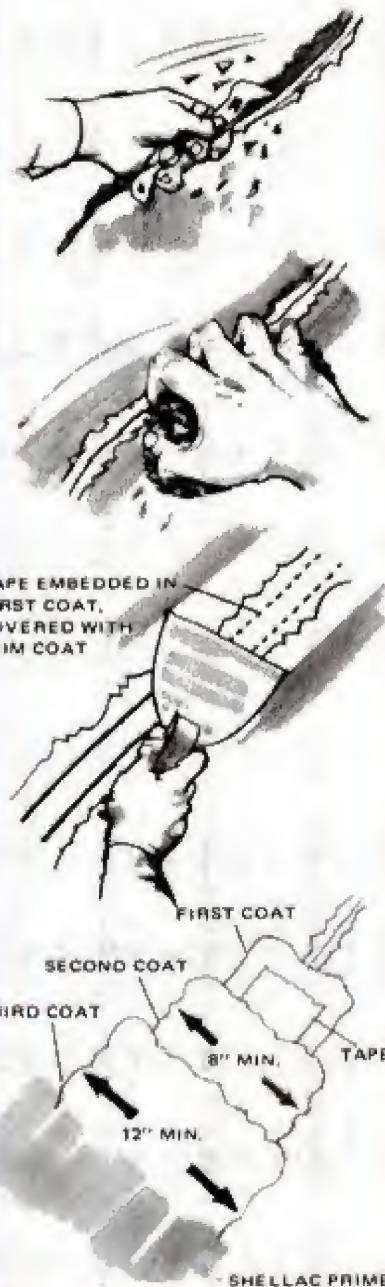
If the switch is in living room, dining room or family room (or any room used for TV watching), a dimmer switch is perfect for creating lighting moods (and saves electricity and lengthens bulb life as well). Installation of a typical dimmer (for incandescent lighting in permanent fixtures) is shown above. Dimmer wires and supply wires are twisted together and solderless connectors (often supplied with the dimmer) are twisted on tightly; the dimmer is fastened to the box like an ordinary switch and the original switchplate replaced. Just be sure not to exceed specified wattage.

9

Patch wall cracks

To assure a good bond between patching compound and wall, the crack should be first V-grooved (special tools are sold, but a can opener works perfectly well) then dusted so that no loose matter remains. Use a large sponge to dampen the crack thoroughly and then apply a first coat of the patching compound, forcing it into the crack with a 4-in. joint knife.

Press wallboard tape lightly into place, then press it into the compound with the knife, pressing hard enough to squeeze a little compound out at the edges. Cover tape with



a thin skim coat. Three coats in all are recommended. Let each dry thoroughly and sand high spots down between coats (sand with care on plasterboard or you may damage paper surface). When the top coat is dry (after at least 24 hours), it can be feathered into adjoining surfaces by rubbing with a slightly dampened sponge. Easy does it, though, or you'll be rubbing the water-soluble compound off.

After the patch has been sponge-sanded, it must be primed or it will show through paint. White shellac is commonly used, but vinyl and oil-base primer-sealers are also suitable. Paint or wallcovering can then follow.



10

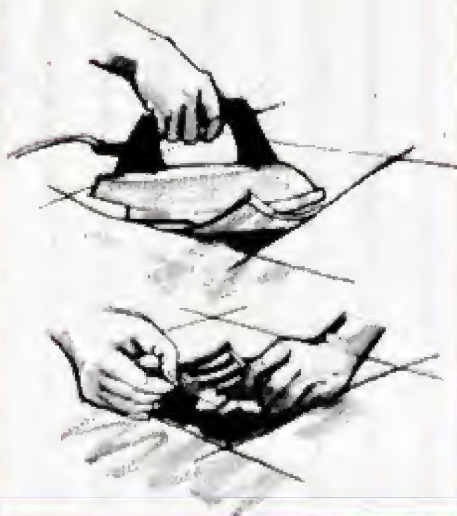
Replace ceiling tile

Ceiling tiles are up where you wouldn't expect them to get broken, but it does happen. You remove damaged tile by carefully cutting it out with a heavy utility knife, a jab saw (a short hacksaw blade with a handle at one end) or a keyhole saw. Clear the area in the frame of staples and bits of tile. To fit the hole, the replacement tile must be trimmed of protruding tongues—a utility knife should do the job. Apply adhesive (the type used with ceiling tile) to the back of the tile and press it into place, level with the surrounding tiles.

11

Resetting floor tile

Floor tiles that have lifted or curled up at edges or corners are a safety hazard as well as an eyesore. Apply a household iron, not to flatten them down, but to soften the old mastic below enough to let you lift each tile out. Then you scrape away as much as possible of the old adhesive and apply new. Press the tile back into place, wipe up excess mastic, and keep the tile under weights overnight.

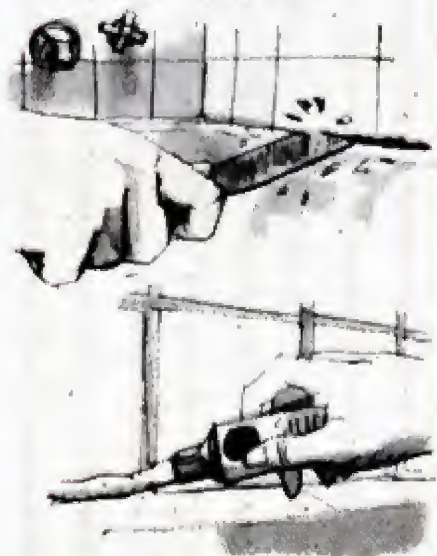


but taking care not to damage either tub or wall tiles. After dusting the cleaned seam, wipe it with alcohol to remove residues that could keep the caulking from adhering. Caulking—a type specifically made for bath use—goes on in an unbroken bead just wider than the crack. Push it *into* the crack with a cloth or wet fingertip, forming a smooth, concave seam. A wet cloth will remove any excess caulking from the tile and tub.

12

Caulking bathtub seam

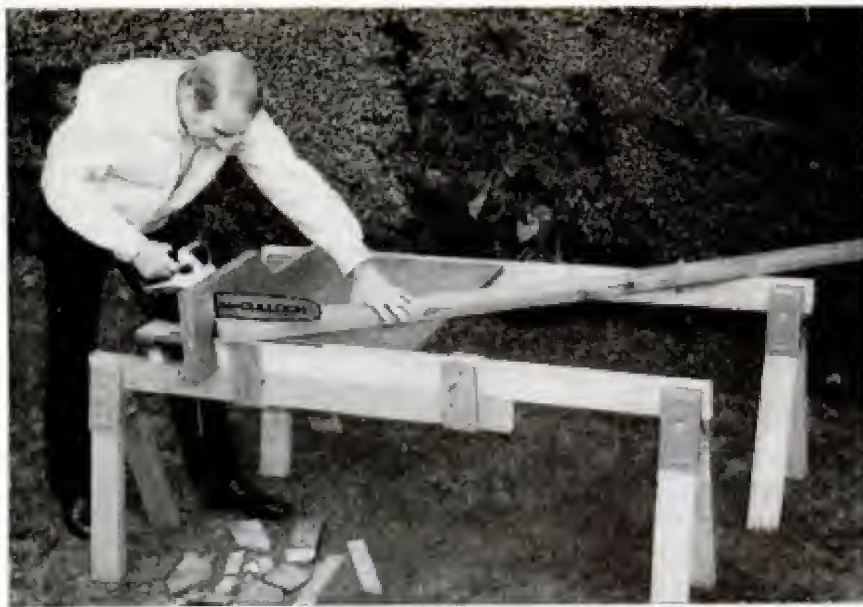
That crack that develops along the rim of the tub is easy to fix with modern caulks. First, make sure you remove *all* the old caulking, gouging it out with a stiff putty knife



... and other things

Naturally, you want your home to look attractive when you're having company—and you want it to be safe, too. This is a good time to do a few other minor jobs that will add to the safety, appearance and convenience of your home—and to your enjoyment of the holiday season.

- Loose carpet—double-face tape will hold it down in most locations. Do the same thing with those throw rugs that are always sliding on bare floors.
- Light up your house number—see page 152.
- Replace your jangling old doorbell with chimes. They're easy to install following the makers' instructions.
- Test your indoor and outdoor decorative lights, replacing bulbs if necessary—*early* to avoid disappointing the family.
- Replace worn catches on kitchen cabinets with new magnetic ones.
- Hide a house key in the yard—but *not* under the front door mat.
- Don't prune evergreens on your property—save that for just before Christmas and you'll have the trimmings for decorative use.



Sawhorse miterbox lets your chain saw do the cutting

by William Waggoner

If you think a chain saw is only for felling trees and cutting firewood, you're in for a surprise. When used in this unique miterbox, it serves as a dandy cutoff saw for framing work. Held in a set position with the work positioned to suit the cut, a chain saw will crosscut and angle-cut 2-in. stock fast and accurately, and actually handle work that's too thick for a portable electric saw.

I made the unit shown to suit my 14-in. McCulloch Mini-Mac, but with slight changes in the dimensions any brand saw can be used. The platform to which the saw is mounted travels up and down on two T-tracks and a pipe post that passes through an eyebolt. To bolt my saw to the wood

platform I simply backed out two capscrews in one side of the saw and replaced them with longer headless bolts (see facing page, top photo).

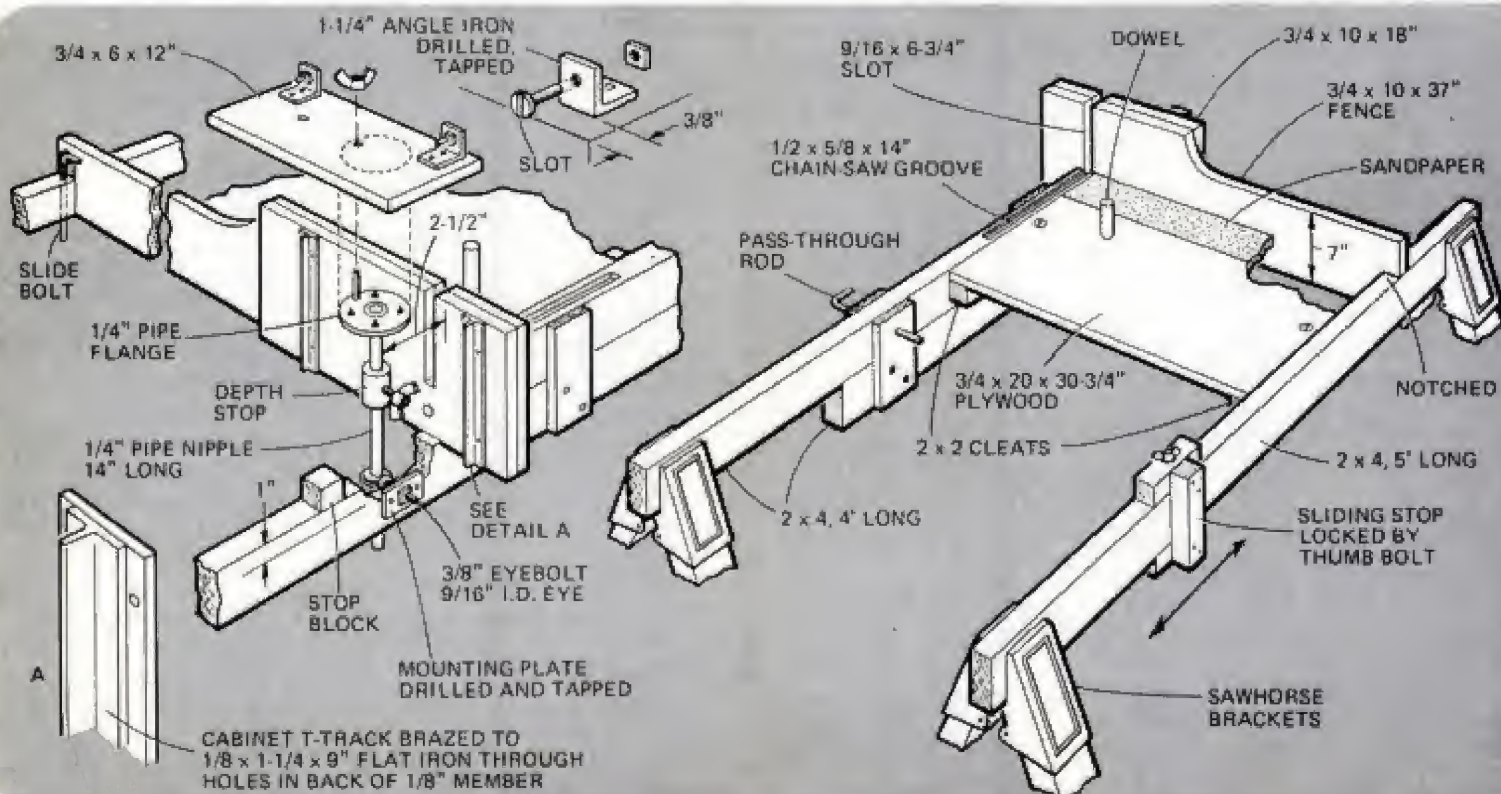
Two V-filed, slot-head machine screws mounted in sections of angle iron ride the vertically mounted tracks to assure a square cut as the saw passes through the work. A wood stop block on the 2x4 rail limits the vertical travel of the saw, and an adjustable collar on the pipe post lets you set the depth of cut. The T-tracks are 9-in. sections of standard sliding-door track brazed to 1 1/4-in.-wide metal strips drilled along the edge for mounting screws.

To make identical angular cuts at the ends of the rafters, you place the work at the desired angle against

a dowel stop and an adjustable sliding stop on the sawhorse rail. With the heel of the member against the fence it can't move as the cut is made.

To make right-angle cuts, you simply remove the dowel pin and place the work against the fence. A strip of coarse sandpaper tacked or glued to the table along the fence helps keep the work from shifting while it's being cut.

Your chain saw can be quickly removed for other work by taking off the two nuts that hold it to the platform. The whole setup can be taken apart for storing as sheet-metal sawhorse brackets are used to clamp the 2x4 rails, and a sliding-door bolt anchors the outboard end of the fence. ★★★



How your Shopsmith can power other tools

If you own a Shopsmith and want to avoid buying motors to drive other woodworking machines—such as AMT's belt sander and jointer—I've found a way to drive them directly off the multitool's powerhead. All you need is a wood spacer block and an add-a-tool coupler, a Shopsmith accessory you may have.

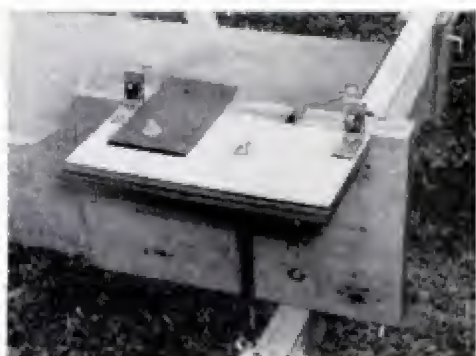
The spacer block is used to align the two shafts horizontally when you switch from the sander to the jointer. In each case the Shopsmith extension table is used to support the machine at the left of the powerhead and is inserted into the two holes provided, with the front of the table to the rear.

Each machine is bolted to its own plywood base, and in use the base is bolted to the top of the extension table. Four bolt holes are drilled through the table so they automatically align transversely the machine shaft with the powerhead shaft.

Placing the extension-table front to the rear provides the added space needed when the sander is used horizontally. Insert the table posts as far down in the holes as they will go and lock them in place. The plywood base will bring the sander shaft directly in line with the powerhead shaft. In the case of the jointer, another $\frac{3}{4}$ -in.-thick spacer block brings its shaft in line.—Ed Dussault.



Bolt saw to wood platform by removing these two capscrews and replacing them with longer headless bolts (arrow).



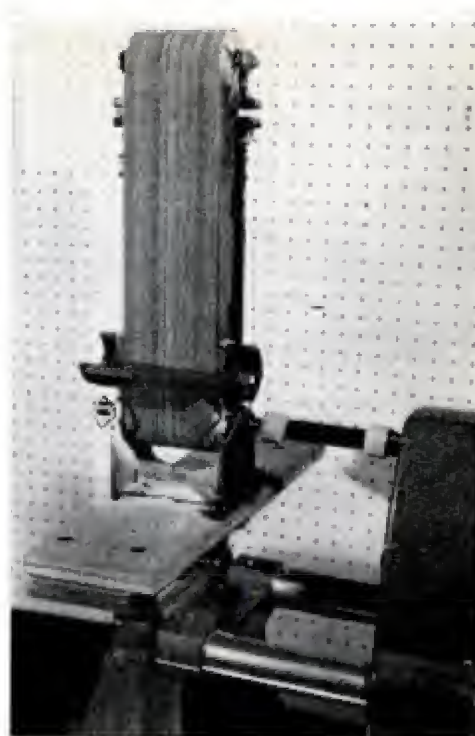
Use bolt-hole template to support platform in the proper position for fastening the pipe flange to the underside.



Use framing square against the bar and clamped to the fence when aligning T-tracks so saw cut is at exact right angle.

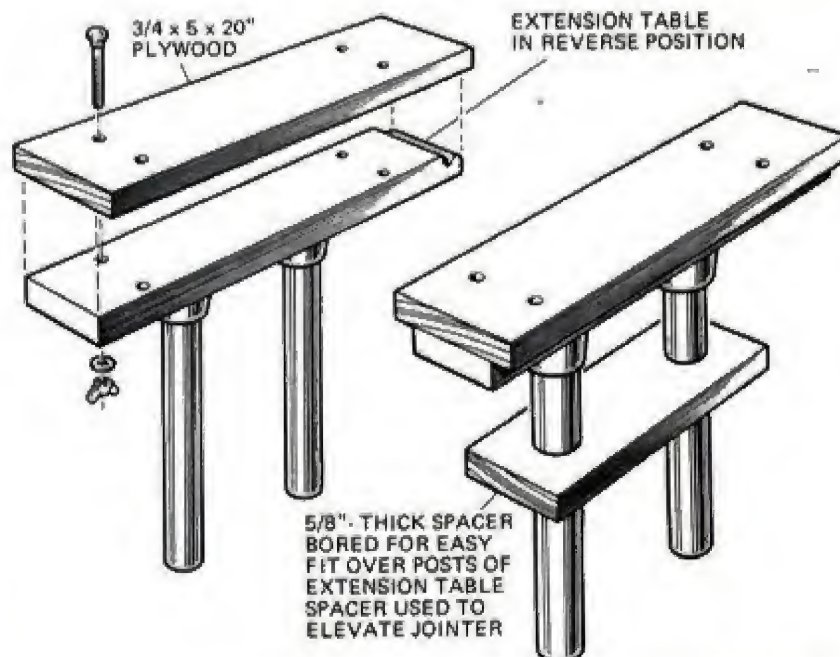
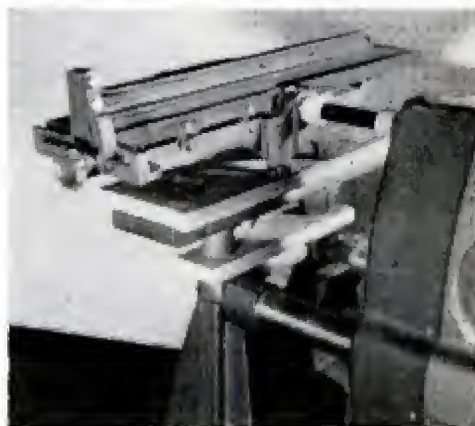


Position work to be angle-cut with protractor against fence. Dowel and adjustable stops let you make duplicate cuts.



Plywood platform thickness automatically aligns belt-sander shaft with powerhead shaft for direct shaft-to-shaft coupling.

In case of jointer, an additional spacer is required to align the two shafts. Shoulders on table posts rest on spacer.



Refinishing furniture is easier than ever

Modern finishes make the beginner a 'pro' the very first time.



Before refinishing, book table is well-worn but good quality piece

PART 1 Stripping, preparing the surface and staining



Water-rinsable remover is applied generously. Finish softens in 10 minutes to an hour, depending on thickness of coating.



Scraping begins when wrinkles appear. Some spots need repeated application of remover. A toothbrush is used in corners.



Wet toweling (or steel wool) and water is used to rub off remover and residue. Piece is then flushed clean with a hose.



Sanding to bare wood—done when thoroughly dry—calls for smooth-cutting finishing sander and hand sanding with pad.



Before staining, wood is given a sealer wash coat so grain will accept stain evenly. Omitting this step is risky.



Stain is applied with brush or cloth, then wiped down to even it out, let dry and followed by a coat of sealer.



Two coats of wipe-on finish applied over sealer with cloth, like furniture polish, produce a beautiful semigloss finish.





Color photos: Steven Fay

By Rosario Capotosto

Time was when clear finishing of wood was a tedious job reserved for the pro or the advanced amateur. But today's improved finishes have simplified methods and improved results to such a degree that practically anyone, with little or no previous experience, can turn out an admirable job the first time around.

A "hand-rubbed" finish used to be just that: high-gloss varnishes had to be rubbed down with pumice powder and oil to obtain a satiny sheen. Now you simply apply a top coat that has been scientifically designed to produce such an effect when dry! Improved brushing lacquers elimi-

nate the need for spraying equipment and the pollution and dangerous fumes. Quick-drying natural varnishes and the remarkable polyurethanes, epoxies, vinyls and alkyds offer exceptional durability and easy-to-apply wood-enriching finishes.

Surface preparation

Generally your interest in finishing will concern new work, old work to be refinished, or old work which is too battered for successful refinishing, thus requiring a transformation. In the first two cases you'll be working on raw wood so surface preparation will require careful attention; a finish coat will accentuate rather than conceal surface defects such as insufficient, hurried sanding, scratches, dents and discoloration.

Removing old finish

Paint and varnish removers have been greatly improved. The new water-rinsable types make the job easier and quicker than the old-fashioned kind. Now you simply lay on a generous coating with minimal brushing and let it stand about 10 minutes until the old finish peels and blisters or becomes gummy. Remove the old finish with a putty knife on all flat surfaces, steel wool in contoured areas and a toothbrush in carved sections.

Follow up with a water rinse, using a towel or sponge to remove the final traces of finish and remover. If feasible, a hosing is suggested. Stains that resist chemical removers must be bleached or scraped. The latter is laborious; do it only as a last resort. The chair shown on page 116 needed such drastic action.

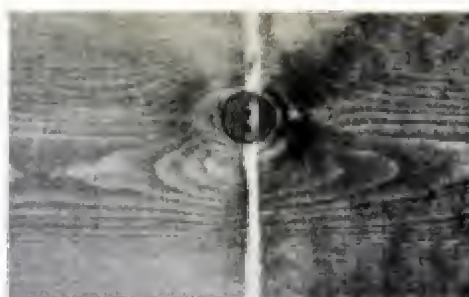
Veneer-lumber furniture must be

Tools and materials required include: (1) toothbrush, (2) paintbrush, (3) scraper, (4) rubber gloves, (5) cloths, (6) water, (7) remover, (8) scrap of styrofoam (pad for sanding edges), (9) abrasive paper.





Pretesting both color of the stain and of final coat material is good practice.



Sealer-wash coat prevents blotchy stain job. Left half was treated, right was not.

GRADES OF SANDPAPER

Coarse	Used to remove old finish (paint, varnish, enamel, etc.), also deep gouges, scratches, stubborn stains and smudges. Coarse paper must always be followed by medium paper, then fine, since the scuff marks made by coarse paper are not only visible but sometimes magnified after a clear finish is applied.
Medium	Used to remove less severe scratches, stains, smudges, etc.; also scuff marks resulting from use of coarse sandpaper.
Fine	Used to obtain smoothness, and to remove slight traces of scratching or scuffing remaining after a previous sanding; also to remove raised grain resulting from sealing or bleaching.
Very Fine	Used to obtain maximum degree of surface smoothness—the key to the finest possible natural wood finish.



Thorough scraping was done on chair (at right) when it was disassembled for regluing. Disassembly made job easier.

Before chair could be refinished, many dark coats had to be removed, but the true character of the wood now shows.



Regluing must be done with care to avoid glue smears; they will not accept stain. Wipe off smears immediately.

Application of stain on the chair is best done with a cloth after all areas have been treated with a wash coat of sealer.



handled with extreme care. Since most veneers are only 1/28 in. thick, it's obvious that scraping shouldn't be attempted. Use only a minimal amount of water for the final rinse, particularly if any of the veneer has splits or shows signs of having become separated from the core. The consequences could be disastrous.

Sanding

Allow the stripped wood to dry thoroughly; then proceed to sand as with new work. Work with aluminum oxide, open-coat abrasive paper. Use a coarse 80-grit paper for heavy stock removal and work with progressively finer grits up to 220. A belt sander may be used for truing or leveling broad surfaces, followed with a power finishing sander charged with 220 paper and a light hand-sanding with 320 paper. Always sand with the grain where possible.

Always sand individual components of construction before assembly because it is practically impossible to do a thorough sanding job on inside corners. When refinishing, disassemble as many parts as possible, if the old glue permits, to allow better access for sanding.

When the major elements have been sanded they can be glued. Here you've got to exercise great care. No kind of transparent stain or clear finish will penetrate or conceal residual glue. Remove *all* traces of wet glue from the surface immediately; carelessness here will show up in the finished work. Scrape off the excess glue with a sharp chisel, taking care not to dig into the wood. Then wipe the spot clean with a dampened

After refinishing, chair is handsomer than when new.



cloth. This will raise the grain slightly so a touch-up hand-sanding will be necessary. Never attempt to sand over wet glue as this will tend to push the glue farther into the pores. After sanding use a vacuum cleaner or tack cloth to remove all dust.

Slight dents in wood may be removed by placing a damp cloth over the area then heating it with an iron. The steam will swell the wood so it may be sanded level with the surrounding area. Small chips and cracks will have to be treated by one of several methods at a later stage.

Staining

Stain is used to enrich the color of wood, to reinforce the grain pattern, and frequently to imitate more expensive cabinet woods. The latter was done in refinishing the little bookshelf table illustrated. When the almost-black old finish was removed the wood revealed a very weak character. The problem was easily solved by applying a heavy coat of natural teak stain, then passing over it with a stiff dry brush to create a teak wood-grain pattern.

Amateurs often get poor results when they stain because end grain and soft spots soak up the stain unevenly and cause dark blotches. The simple trick of applying a wash coat of sealer to the wood *before* staining will prevent this common problem and assure an even coating. A wash coat is generally made by diluting a sealer in five or six parts of its solvent. Never apply the sealer full strength before staining—it will keep the stain from penetrating.

There are several types of stains but for home shop use the ready-mixed oil stains are highly recommended. They're available in numerous wood tones and colors. Water stains are difficult to control, they raise the grain and sometimes loosen glue. They're really for factory use.

Pretest the stain you plan to use on a scrap of wood of the same species as the job or on some concealed area of the piece to be sure of getting the desired color or shade. It's a good idea to go one step further and test the top coat because this too will have an effect on the finished job. Stain can be applied with brush or cloth, but the latter generally works better. Wipe off the excess before it gets too dry, using a clean lintless cloth. Drying time is usually overnight.

Next month you'll be taken through the steps of filling open-grain woods with paste filler. You'll also be shown the tricks the professionals use to repair dents and scratches and how to apply the popular self-rubbing urethane finishes. ★★★

Commercial finish stripping

The removal of old finish can sometimes be quite tedious and time-consuming. There is a shortcut available to you if you'd like to skip the chore. Simply take the piece to a stripper. They're listed in local directories under Furniture Stripping.

Your piece will be dunked into a huge tank of remover until every particle of finish is removed. A high-pressure water hosing and an application of a special "restorer" leaves the wood ready for finishing when dry. Prices are quite reasonable, ranging from \$8 to \$50 depending upon the size of the piece.



Piece to be stripped is dunked into huge tank of heated chemical remover. It is completely submerged and allowed to soak for a few minutes.



A light brushing, followed by a high-pressure water hosing removes the old finish and the chemicals. Pieces which can't take hot solution (veneers, laminates) are treated in a cold-process tank.



Final step in the process is a spraying with a special chemical which restores the wood to its original color. These photos were taken at Yankee Antique Workshop, Inc., Huntington, N.Y.

6 fun-to-make



*Giraffe
coat tree*



*Circus-wagon
toy box*



Hale the whale

Wood-block train

toys for Christmas

A Christmas toy should be very special—and what could be more special than a toy made by you? You can be sure the six fun-to-make, fun-to-get toys you see here will make your youngsters happy on Christmas morning. You'll find plans on following pages.

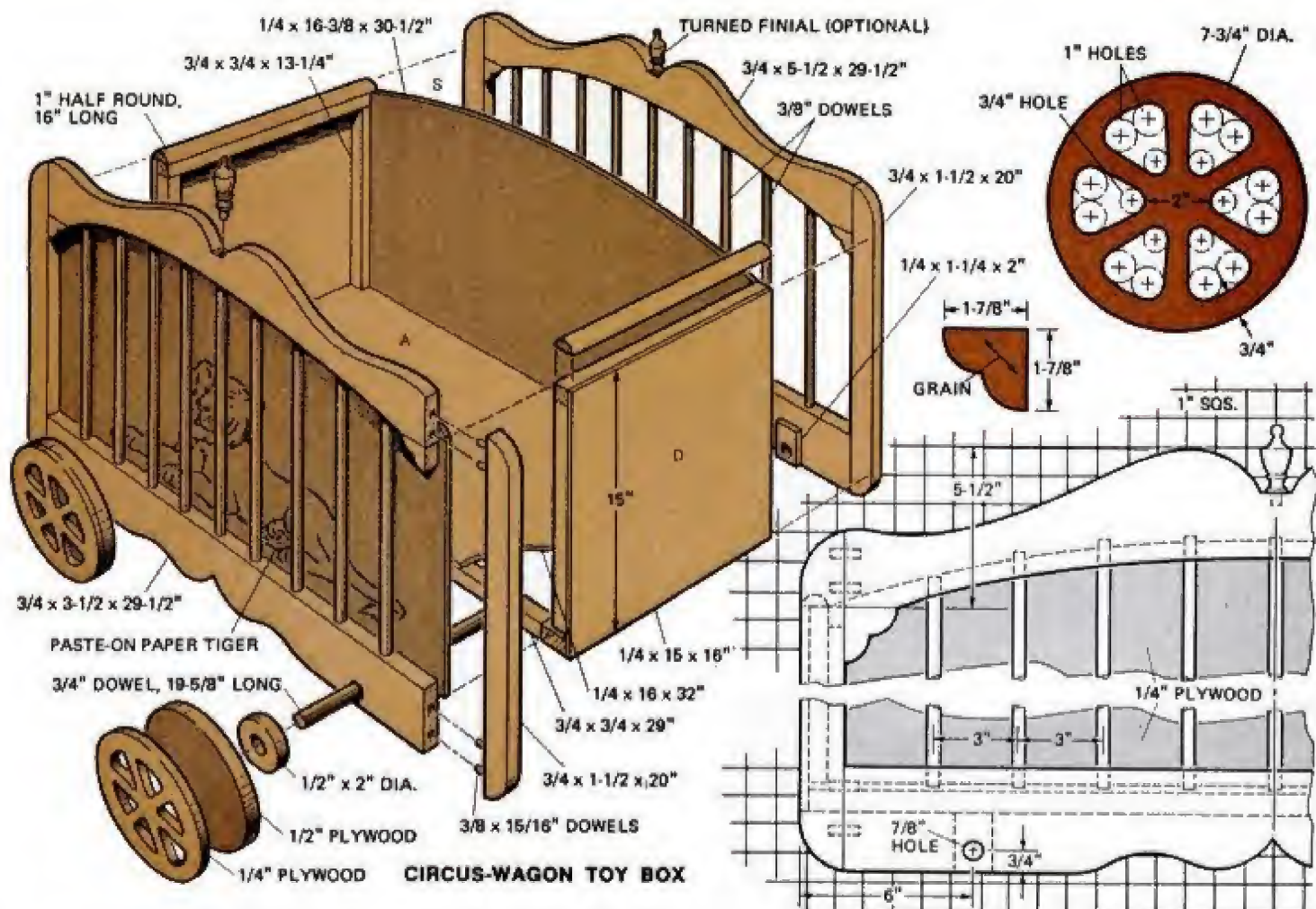


English
farmhouse
dollhouse



Puff puff
engine





Adjustable doweling jig (Sears) simplifies drilling and aligning mating dowel holes in lower and upper side members.



After holes are bored, curves in top and bottom members are cut with sabre saw. With dowel bars in place, ends are added.

Colorful touch for kid's room

A most practical gift is a toy box—even Mom might like to have it to corral the many toys Santa leaves. This one, a classy little circus wagon, will add color to any kid's room.

Sides of the wagon are carbon copies. The holes for the nine bars are drilled before the top and bottom members are sabre-sawed. In fact, each side can be made a simple rectangular frame to start before any of the pieces are bored and sawed. If you have a doweling jig, use it to bore mating holes dead-center and 3 in. apart. Make a full-size pattern from the half pattern given and trace the curves on your wood. For perfect alignment, drill the holes for the 3/4-in. dowel axles through both side assemblies at one time. Enlarge the holes slightly with a round file or sandpaper wrapped around a dowel.

The 7-in. wheels consist of two plywood discs and a hub. The spokes are jigsawed first, then the 1/4-in. thickness is glued to the 1/2 in. and both are sawed round as one. The hubs are centered and glued to the wheels, then 3/4-in. holes are bored through both hub and 1/2-in. disc.

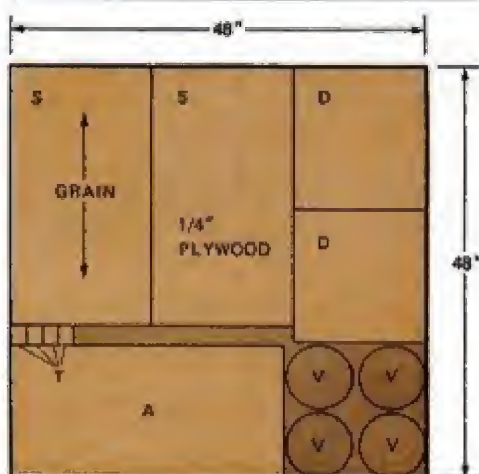
The completed sides are glued to a simple 1/4-in. plywood box and the cutting layout shows how the five parts can be laid out economically on a 4x4-ft. panel with wood to spare

for the wheels. They are glued to 3/4-in.-square members which are placed inside the ends and under the bottom. Sides of the cage are finally glued to the box; then panels S are painted white, and the paper tigers are attached with rubber cement and finally nailed in place behind the bars. Wheels are glued to the dowel axles to complete the project.

(Please turn to page 122)

HOW TO ORDER PLANS

If you prefer to build your circus wagon from a full-size plan which includes two colorful paste-on paper tigers and material list, send \$1.50 to Home and Shop Editor, Popular Mechanics Magazine, 224 West 57th St., New York, N.Y. 10019.



CUTTING LAYOUT

NOTHING IN THE WORLD BEATS BEING THERE FIRST.

It's every fisherman's dream, every time he goes fishing: To get that first early-morning chance at a lunker that's been waiting all night for someone to make the offer.

Somebody's going to be there, in your favorite spot, ahead of the pack. Why not you?

A properly set up Evinrude Sport motor can help give you the all-important performance edge you need.

There are four Evinrude Sport models: 200, 135, 75, and 55 horsepower. Each with distinctive silver blue styling, and with the versatility for family skiing and cruising while you're resting from fishing.



For boats with its rating, it's hard to beat an Evinrude Sport 135. It has all the top-of-the-line Evinrude features, like Firepower electronic ignition, power-assisted shifting, and low friction pressure-back piston rings.

Plus built-in extras like power tilt and trim for fingertip control of boat attitude and running efficiency. SST performance propeller that improves miles per hour and miles per gallon. And a heavy duty 15 amp alternator.

You have to get up mighty early to beat an Evinrude 135 to the honey hole. Unless you own a new Evinrude 200.

Free new '76 catalog: Write Evinrude Motors, P.O. Box 663, Milwaukee, WI 53201.

EVINRUDE 
DIVISION OF OUTBOARD MARINE CORP.
first in outboards

FUN-TO-MAKE CHRISTMAS TOYS

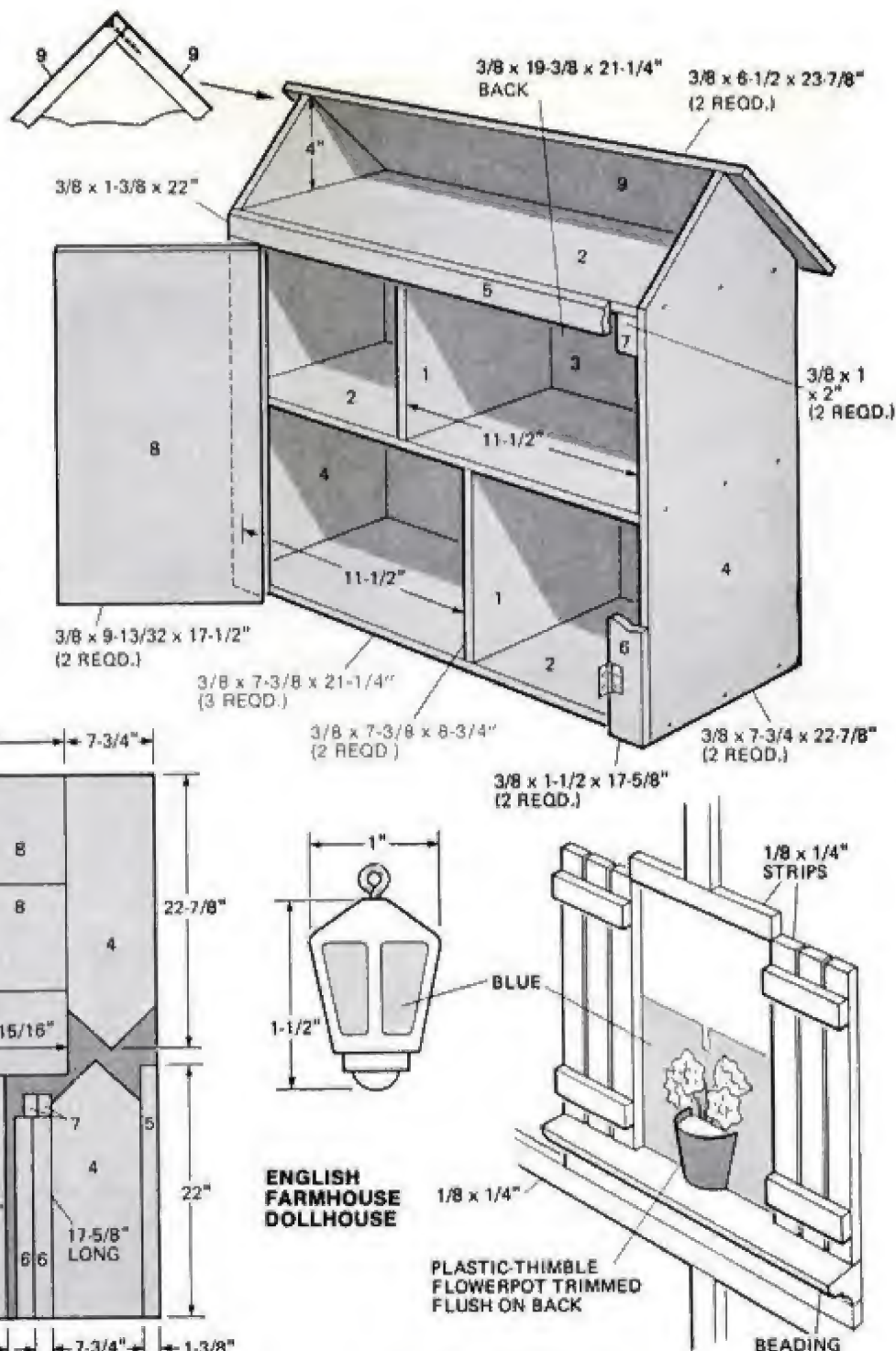
(Continued from page 120)

Any little girl's favorite

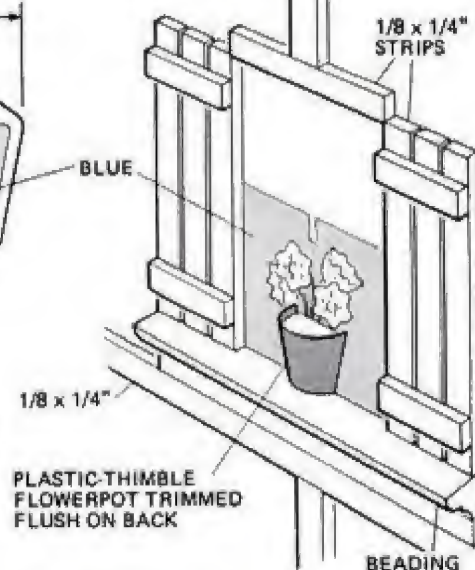
Next to a doll, a dollhouse is perhaps the most wanted gift for any little girl. Here's a simple one Dad can make in a weekend. It's designed by Mary Schreck, noted dollhouse furniture designer and miniaturist, after an early 19th century English farmhouse. The front opens wide to provide full access to four rooms.

The 17 parts can be cut from a 4x4-ft. piece of $\frac{3}{8}$ -in. plywood. Follow the diagram below when laying out the parts, but follow the dimensions when cutting.

Start assembly by nailing and gluing the three floors to one end, inserting partitions as you go. Then add the second end and the back. Glue parts 7 next, then part 5, and parts 6. Hinge panels 8 to the front and add the roof.



ENGLISH FARMHOUSE DOLLHOUSE



CUTTING LAYOUT

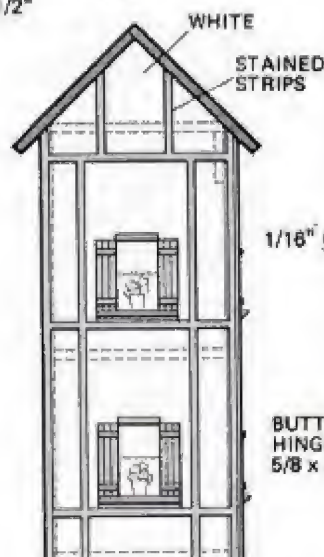
Paint the house white; then decorate ends and front with stained wood strips as shown in front and end views. Paint on windows and doors, and fit them with shutters, window boxes and plastic thimble flowerpots.

Two good sources for dollhouse furniture are Federal Smallwares Corp., 85 Fifth Ave., New York, N.Y. 10003 and Lee Wards, 1200 St. Charles St., Elgin, Ill. 60120. Both have catalogs for a small charge.

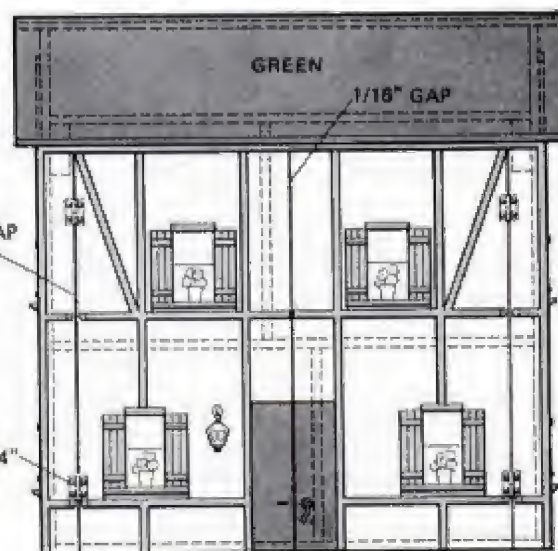
(Please turn to page 141)

HOW TO ORDER PLANS

If you wish, you can work from a set of full-size plans (two 24 x 38-in. sheets) which include a complete materials list and step-by-step instructions. Send \$2 to Dremel Manufacturing Co., Dept. PM, 4915 21st St., Racine, Wis. 53406.



LEFT END



FRONT

Banff National Park, Alberta, Canada



Canada at its best.

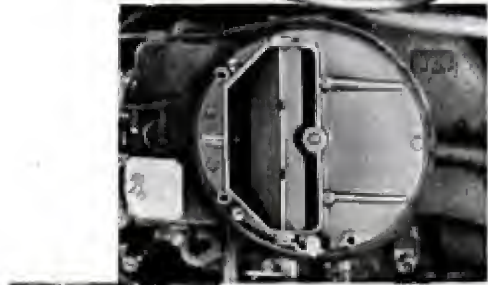
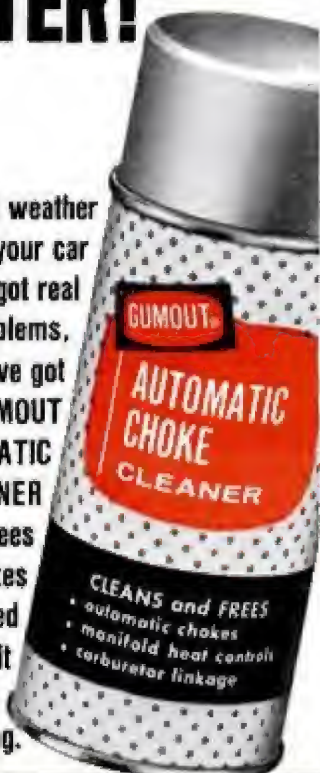
Try the light, smooth whisky that's becoming America's favorite Canadian.
Imported Canadian Mist.

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When cold weather chokes up your car you've got real starting problems, unless you've got a can of GUMOUT AUTOMATIC CHOKE CLEANER handy. It frees sticking chokes fast. Used regularly, it prevents sticking.



Squirt it on both ends of choke valve shaft and all the carburetor linkage. In seconds the foul-up's ended! Gum, carbon and dirt are gone!

Use GUMOUT CHOKE CLEANER also to free manifold heat controls bound by dirt, rust, and carbon. It works fast.



Gumout, Cleveland, Ohio 44104

F-16—THE FIGHTER EVERYBODY WANTS (Continued from page 73)

feet). It's also a lot lighter, grossing 22,500 pounds against 57,300 for the F-14 and 40,000 for the F-15. Its small size and low weight are actually the secret of the F-16's phenomenal performance. Compared to other typical fighters, it has three times the combat range, nearly twice the acceleration rate and less than two-thirds the turning radius at supersonic speeds—all of which mean it can outfly and outfight just about anything else around.

Mach 2 speed at combat height

Powered by a 25,000-pound-thrust Pratt & Whitney F100 turbofan engine, the F-16 is capable of speeds up to Mach 2—twice the speed of sound—or nearly 1500 mph at combat altitudes. It is, in fact, one of the few fighters that can continue to accelerate while climbing straight up.

The F-16's short turning radius and high acceleration allow it to "close" with an enemy aircraft and come out on top—the key to combat superiority in one-on-one dogfight-type situations. Standard armament consists of two wingtip-mounted Sidewinder missiles and a 20-mm Vulcan cannon capable of an awesome firing rate of 6000 shots a minute. Up to 11,000 pounds of additional armament can be carried on under-wing pylons—extra missiles, bombs, napalm, special weaponry—whatever is required for the mission.

For long-range operation, there is provision for midair refueling or external auxiliary fuel tanks. It's this kind of flexibility that makes the F-16 such a versatile, all-purpose plane—it can carry out air-to-air, air-to-ground, ground support, long-range bombing, fighter escort and carrier-based operations.

The F-16 is both complex and simple—highly sophisticated in design, yet ingeniously simple in construction. Elevator panels, wing flaps and most of its main landing gear are interchangeable—a repair depot need stock only half as many parts as usual. Servo-actuators operating the controls are identical and interchangeable. The fuselage is designed in three modular sections—nose, midsection and tail. The modules can be built in different factories—even in different countries—then assembled when needed. If one module is damaged, it can be replaced with a duplicate—like changing a fender on a car—without keeping a valuable plane out of service for time-taking repairs.

The P&W F100 engine is the same time-proven one used in the F-15 so engine stocks, replacement parts and

maintenance know-how are well established. Of the F-16's 373 equipment components, 257 are stock off-the-shelf items. Only 50 types of fasteners are used—all standard—against up to 250 for other fighters.

Now you can begin to see why so many countries are intrigued by the F-16—its economy and simplification are an air force's dream. The advantages of having a number of NATO nations operating the same aircraft are obvious—parts, training and manufacturing facilities can be pooled, urgently needed items can be shared, stockpiling of many components is reduced, and repair and maintenance are vastly simplified.

Entire plane a 'lifting body'

Aerodynamically, the F-16 is a masterpiece of engineering ingenuity. The flattened, oval fuselage blends into the wings so the entire plane becomes, in effect, a "lifting body." Forebody strakes—narrow, flaring strips ahead of the wings—help prevent wing-root stalling at high angles of attack, adding lift and improving maneuverability. Leading-edge wing flaps, which also increase lift, are computer-controlled and function automatically according to speed and attitude—the pilot can concentrate on fighting without giving them a thought. Trailing-edge flaps and ailerons are combined into "flaperons" that operate independently as ailerons, collectively as flaps—another simplification.

All controls are electrically operated by so-called "fly-by-wire." This eliminates mechanical linkages more prone to failure, provides more sensitive, responsive handling and increases pilot safety. Backup control wires continue to function even if other wires are shot away—not possible with cable linkages.


The special "high G" cockpit incorporates a sharply back-tilted seat—30° compared to the usual 13°—to help the pilot withstand high G forces in combat. A "side-stick" controller, found to produce more precise maneuvers, replaces the old between-the-knees control stick. Speed brakes that open out like a book near the tail let the pilot slow quickly for emergency maneuvers or short-field landings.

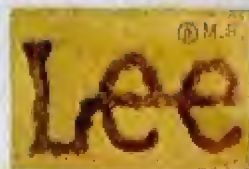
All in all, the F-16 is a lot of plane for the money. It's expected to give the NATO nations air superiority through the '80s and into the '90s. Its purchase by so many other countries has already been hailed as "the sale of the century." Actually, the F-16 may well turn out to be the *buy* of the century. ★★



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The Stockman. A tough breed of coat in heavyweight navy denim (\$37.50) or dressy blue chambray with 100% Acrylic pile lining and collar (\$42.50). Pants are Lee-Prest® houndstooth check Boot-Cut® flares (\$12.49) and chambray Boot-Cut flares (\$12.29). The Lee Company, Work & Western Wear Division, P.O. Box 440, Shawnee Mission, Kansas 66201.

A company of  corporation



Now, even camera straps are getting interesting

New strap designs make camera-carrying easier—and even more decorative. PM's Photography Editor tries on a few for size.



Mac Strap, invented by a *National Geographic* photographer, has offset at top to resist sliding off shoulder.



Dual-camera Mac Strap holds two cameras, lets you grab either without tangling, detaches quickly (but keep the camera with the long lens lower). It's \$13; single-camera models are \$7 each. From McBain, 4853 Cordell Ave., Bethesda, Md. 20014.



Wide straps are common, decorative, comfortable. This one is a Casual Carrier, \$5, with soft-rubber, nonskid back; but check—rougher straps can irritate your neck.



Posigrip 35 gives secure grip, is comfortable on cameras of average height (but not the tiny Olympus). \$7 from Novacon, 1101F Victoria, Costa Mesa, Calif. 92627.



Necksaver will prevent your camera from swinging as you walk, with Velcro glued to the camera. Available for \$7 from Neck-saver, Box 1712, Oakland, Calif. 94604.



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if I really enjoy
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I sure do. And Salem Longs are why. They give me all the good cigarette taste I'm smoking for. Plus Salem's fresh menthol. And they're longer, too. That's why I enjoy smoking. That's why I smoke Salem Longs.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

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WINNEBAGO ANNOUNCES A HOMEOWNERS PLAN FOR



What happens after you drive your new motor home off the dealer's lot? That's a very big question.

Because a motor home is a very big investment,

At Winnebago, a great deal happens. We call it our Winnebago Homeowners Plan. And you can drive away with it on any new 1976 Winnebago.

Better Protection.

Winnebago's limited warranty is designed to comply with all requirements of recent Federal legislation. Further, Winnebago has made some substantial improvements in coverage. Items previously covered for only 90 days are now included in our standard 12-month/12,000-mile coverage periods.

This includes such features as carpets, electrical systems, plumbing, seats, cushion fabrics and windows.

We think this greater protection, along with Chrysler's solid 12-month/12,000-mile chassis warranty, makes the overall Winnebago warranty the best in the business. If you find a better one (be sure and read the fine print), let us know.

Service, Service Everywhere.

No one buys a motor home to sit in the driveway. So Winnebago has put together a network of over 300 coast-to-coast, factory-trained service centers. From Miami, Florida to Anchorage, Alaska. One reason there are more Winnebago homeowners on the road is because of the service they can depend on along the road.

A Friend at the Factory.

If a Winnebago owner ever has any questions, suggestions or complaints, he can get in touch with our Customer Relations Department at our corporate headquarters in Forest City, Iowa. This department is staffed by knowledgeable factory technicians and is there to handle any special problems that might arise.



Safety First.

You'd never hoist your motor home several feet in the air and then deliberately drop it. But that's what Winnebago did recently to test the limits of structural integrity of their exclusive Thermo-Steel® construction. That test is only a part of an extensive safety program initiated by Winnebago. Not required by the Federal Government. Before you become a motor home owner, make sure you compare safety programs.

Joining the Club.

Every new Winnebago homeowner belongs. Because the first year's membership in the Winnebago International Travel Club is standard equipment on any Winnebago model. There are 269 active W.I.T. Clubs across the country. Any Winnebago dealer can tell you about twelve valuable club services.

More Money Back.

Part of any smart homeowner's plan should be consideration of resale. Based on a comparison of three-year-old motor home prices taken from the May-August, 1975 N.A.D.A. Recreation Vehicle Appraisal Guide, Winnebago held a higher resale value than the average of listed competitive models.

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For 1976 Winnebago offers a great selection in motor home size, style and price. You don't become the nation's most popular motor home manufacturer without providing what your customers want.

At Winnebago, we try to give you more to choose from. And we think our Homeowners Plan gives you a lot more to drive away with.



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about a foot in front of them. Inside the hull was a litter of bobbing furniture, clothing, boxes, empty cans and other containers.

Divers held their lights before them, felt their way, and moved down the companionway to the living quarters where crew members had been reported sleeping at the time of the accident. They found no one.

Retracing their steps to the galley, they searched, looking for any air pockets where a huddled survivor might be able to gasp breaths of air. They worked their way carefully through floating galley equipment. One hand-held light pierced the surface in the blackness.

Derrell Jonn Dore, perched on a large pipe with his head in an 18-inch air space, reached out and grasped the diver's wrist. The startled diver jerked his hand away.

Feared poisonous gas

Dore had heard the divers tapping on the hull and had tried to tap back with a knife handle. Hours went by and he had just about given up. "I dozed off at one point and was awakened by a bubbling noise. I thought poisonous gas was coming into the room, but it turned out to be air."

Lead diver Mowry said Dore was in good shape when found because the air in the pocket was fairly clean.

"He was concerned about losing his glasses but he was very calm and relaxed and did exactly what we told him," Mowry said.

The divers had brought along an extra helmet, which they slipped over Dore's head. They secured it with a "jock strap" that ran under the man's crotch. It was used "in case Dore should panic and try to wriggle out of the helmet on the way to the surface," Mowry explained.

The trip went smoothly. Dore climbed the ship's ladder unassisted, was transferred to the *Jean G* and put in a decompression chamber.

Dore had spent 22 hours in the water-filled compartment 10 feet below the sea surface. The depth was so shallow that decompression wasn't needed. Still, Lowry opted for two hours of chamber time to guard against a possible air embolism.

Persons not used to diving gear have been known to hold their breath on ascent rather than breathing normally. This causes air in their lungs to expand, rupturing lung tissues and forcing air bubbles into blood vessels. The result can be fatal.

Encouraged that more of the missing crew members would be found, the rescuers plotted their next dives.

Only the engine room in the stern of the hull remained to be searched.

Exterior survey dives were made to locate the engine room hatch. Cables and floating debris enshrouded the stern deck. The hazard of fouling diving hoses was too great. Mowry decided to continue using the bow hatch even though it meant the divers must travel by touch and hand-light nearly 100 feet through the darkness and debris-filled guts of the rig. There was no guarantee that the rig wouldn't shift, expelling any remaining air pockets, and sink to the sea bottom, carrying the divers with it.

Mike Mason made the first long dive, threading his way through the hull. On the down side of the stern, 20 feet below the surface, his helmet broke water. He looked into the eyes of four exhausted, sick survivors desperately clinging to pipes and valve handles to keep their heads in a pocket of air. A thick scum of diesel fuel lay on the water, filling the air with nauseating fumes.

The trapped men had given up all hope of rescue. To keep awake during their 26-hour ordeal, they had talked to each other, and, just before Mason found them, the conversation had been about their families, about dying and where they would be buried. They prayed together. Their only light was a glimmer from the luminous dial on a wristwatch.

Suddenly—a light and a diver

"It was miserable," Joseph Bellard said after his rescue. "I had to keep moving and the diesel fumes were almost putting me under. I had just about given up hope. I was drowsy and I propped my head up when all of a sudden there was a light and this diver came out of the water. You never heard such hollering and screaming."

Mason relayed the news to his tender, Byron Gray, who had remained at the galley hatch. Gray surfaced to get an extra helmet. He carried it below to the engine room where he and Mason helped Bellard, the weakest of the four survivors, put it on. Gray guided Bellard back through the dark water of the 100-foot length of the hull and up to the waiting arms of the topside crew.

Mason remained with the trapped men in the engine room throughout the five hours it took to guide them out, one by one.

In the meantime, Dore was out of the first decompression chamber and two additional double-lock chambers had arrived and been set up. There would be no wait for treatment.

Jeff Terai made the next dive and the situation, already dangerous, was made more so when his phone cable malfunctioned, causing him to lose communications. Though reduced to using hand signals in the murky engine room, he managed to dress out a survivor in a helmet and take him to safety.

Rescues brought tears of joy

Jim Madgen made the final two dives. It was near dusk on Monday, June 2, when Delvan Irby, last of the trapped men, was escorted to the surface and a decompression chamber. This broke the tension—and some of the weary divers wept for joy. It takes a lot to bring tears to the eyes of a tough offshore diver, but the realization that the lives of five men had been spared was enough.

Only one crewman was still missing. He reportedly was last seen soon after the rig capsized. He was on the surface, clinging to an oil drum.

Divers combed the waters surrounding the rig and under it, but failed to find the man. Diving operations finally were halted shortly after midnight, June 3, though Coast Guard vessels continued to scan the area until late that same day. The man's body was found several days later, floating about five miles north of the rig.

Salvage efforts, headed by Capt. Al Veverica of Belle Chasse, La., began a few days later. Two of the jacked-up legs of the rig had settled into the mud bottom, causing a vacuum effect. The problem was complicated by a spaghetti of live oil pipelines on the bottom which, if broken, could cause an oil spill.

Hampered by almost continuous rough weather, the salvors finally removed everything from the hull, cut off the huge pontoon mat and the jack-up legs and, in August, towed the hull into Morgan City.

Cause of the accident, the second for this rig, is only speculation. The captain of the tug towing the rig said there were two freak waves just prior to the capsizing. One diver theorized that when the rig began its transit and the legs were jacked up, a heavy layer of mud clung to the pontoon mat. Later, when mud on one side of the mat was washed off, the rig tilted. Another opinion is that pontoon ballast tanks on one side leaked and that weight of accumulated water made that side heavier.

Whatever the cause, the accident demonstrated once again that offshore oil workers have picked a tough—and sometimes fatal—way of making a living. ★★

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TABLETOP HOCKEY GAME

(continued from page 95)

chucked in your electric drill. First run a 1/16-in. bit through the center of the dowel, letting the drill protrude about 1/8 in. Then with bit and dowel still chucked in the drill, turn down the end of the dowel with a chisel so it's 1/4 in. in diameter and 3/16 in. long. The tighter the dowel on the bit, the better it will resist loosening in use. Clamp the pegboard to the top of the laminate, even with the edges, and drill the 1/16-in. holes. It will take about two hours to zip through the 2360 holes.

Plenum under playing surface

A bottom in the box-like assembly forms a 2-in. air plenum under the playing surface. Make it the same size as the top and cut an opening in the center as shown to suit the blower used. I selected a used Vent-a-hood range exhaust fan with two 1/25-hp, 1550-rpm motors, each driving a 3 1/2 x 4 1/2-in. squirrel-cage blower. You'll notice in detail A that an air baffle, slightly larger than the blower opening, is made and attached to the underside of the playing surface directly over the inlet. Make the two goal boxes to measure 3 1/4 x 10 in. inside and glue them to the underside of the playing surface, along with the baffle, then glue the boxes to the bottom, making sure the two panels are aligned.

Dadoes in the 6-in.-wide particle-board sides make the plenum airtight. Use glue and nails and let the ends lap the sides at the corners. It is important that the plenum be airtight. You can paint the sides or cover them with wood-grain Con-Tact paper. The original was faced with prefinished paneling. Here you can lap and butt the ends at the corners and hide them with outside corner molding, or just miter and glue the ends without molding. One-inch aluminum angle fitted around the top and inside provides a metal bumper for the puck. It's mitered at the corners and attached along the top with ovalhead screws in counter-sunk holes.

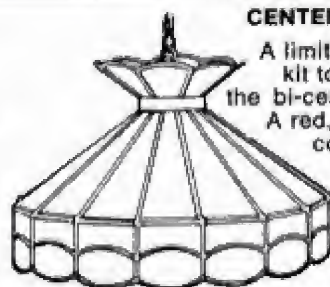
Mallets made from plastic

Each player has a goalie mallet made by cementing three 1/4-in.-thick Plexiglas discs together and attaching a dowel handle. The puck is simply a 2 1/2-in. disc cut with a circle cutter from the same material. (Mallets and puck may be purchased from Sears.)

Folding tubular legs are attached to the bottom of the plenum to clear the blower unit. You can buy them from several mail-order firms. ★ ★ ★

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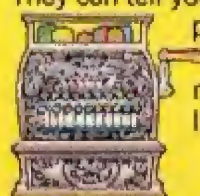
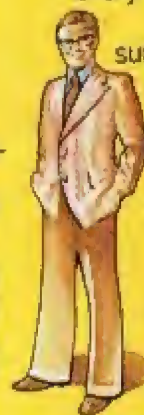
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DRIVING ALFA ROMEO'S NEW ALFETTA *(Continued from page 92)*

out of the way of the pylon pushers.

Contributing to the Alfetta's balance is its transaxle: Clutch, flywheel, five-speed gearbox and differential are all between the rear wheels. This design offers excellent weight distribution for a front-engine/rear-wheel-drive car.

The rear axle, the De Dion type, has the advantage of keeping rear wheels vertical to the ground. The load on these wheels is reduced by placing the rear disc brakes inboard (visible in photo on page 92). This means excellent adhesion of tires under all road conditions.

"All road conditions" is exactly what I encountered recently while driving both Alfetta models in Italy. The occasion was the introduction of the car to U.S. dealers and a few members of the press. Almost 200 cars were involved, so the trip from Alfa's main headquarters in Milan to the Alfasud (Alfa South) facility near Naples was supposed to be in an orderly caravan on a prescribed route—hardly the best way to try out a new car.

Deviating from that route (between Bologna and Florence) proved to be the high point of my trip: I was, at last, on the very roads used in the legendary and now defunct 1000-mile Italian road race—the Mille Miglia. I was in the GT for that stretch and the 60 or so kilo-



Alfetta GT has tach right under your nose, other gauges out in right field.

meters were absolutely exhilarating. The GT's road-holding is superb—even when the car finally breaks loose when pushed to the limit, its behavior is predictable.

Numerous times on those roller-coaster roads I found I had the accelerator pressed hard against the floor—not so much a comment on my ability (or foolishness) as a driver as on performance of the U.S. model. It's strong, willing and totally adequate, but has nothing left over—just as well, since that's what gets you in trouble. I'd like to take that lovely route over the Futa Pass

again, but in, say, a Town and Country station wagon, so that I'd be forced to enjoy the countryside moving by more slowly.

The final leg of the drive to Alfasud was on a stretch of *autostrada* as yet unopened to the public. It was there that I pushed the Alfetta (this time the sedan) to a rock-steady, indicated 100 mph—which seemed a more realistic top speed than the claimed 109.



Alfetta sedan has practical instrument layout and other advantages over the GT.

I didn't check fuel economy for the GT (curb weight 2300 pounds) or sedan (2700 pounds), and there's no way I could have gotten the 25 mpg the EPA rates the Alfetta for highway driving. Even here, driving at 55 mph that figure is high, since it does not consider aerodynamic drag and other real world factors. Still, a realistic 22, 23 or 24 mpg is terrific for a four-door family sedan of Alfetta caliber.

I'd prefer the sedan over the GT if I had to select one to live with. GT styling is offered for \$1200 more than the sedan, but the sedan offers so much more—in sensible design: Comfort, visibility, accessibility, luggage space, even instrument layout, are more practical in the sedan. While hardly rakish, it's flair marks it as unmistakably an Alfa. That would be enough for me—especially since there's no sacrifice in performance or handling.

The sedan is on a 98.8-inch wheelbase, the GT on 94.5. Overall length of the sedan is 172.4 inches; the GT, 171.0. The sedan is 56.3 inches high; the GT, 52.5. Both models share all mechanicals, including the five-speed transmission, four-wheel disc brakes and rack-and-pinion steering. Tires on GT are slightly bigger: 185/70 HR 14 vs. 165 SR 14.

It's obvious I found the Alfetta exciting. I also discovered that Alfa Romeo management and its U.S. dealers are very enthusiastic groups—important to drivers who demand a lot from their cars—and the people who make and sell them. ★★



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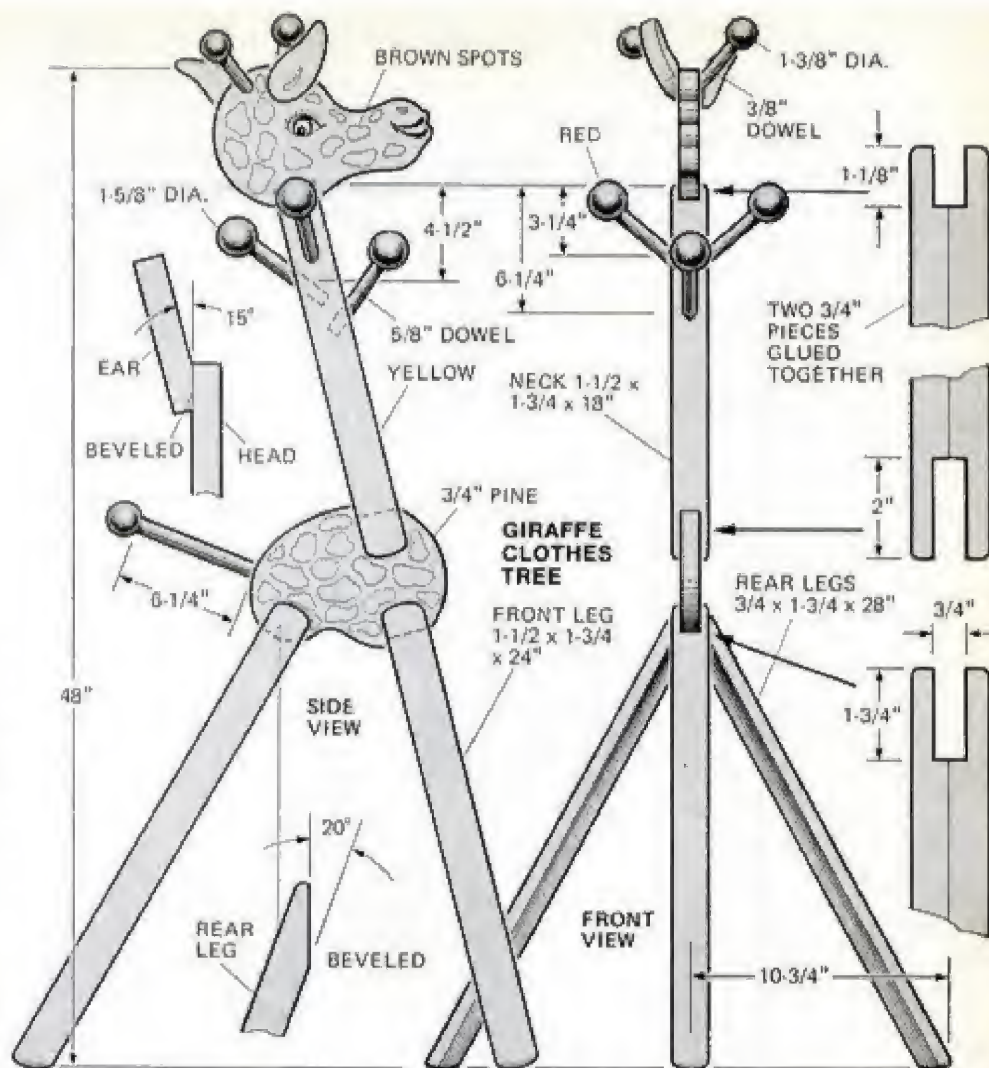
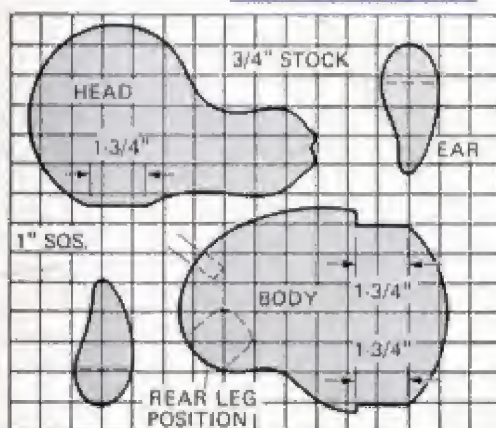
6 FUN-TO-MAKE CHRISTMAS TOYS

(Continued from page 122)

He'll hold their clothes

You'll be surprised how this long-necked, three-legged fellow can get little ones to hang up their clothes. Sawing the head, body and ears is hardest; the rest is easy. Ears are beveled on the inside to point outward when glued in place. Front leg and neck are two 1x2 pieces notched at ends, then glued together. Balls on ends of the pegs are wood finials you'll find at lumberyards and craft centers. Note that the top balls are smaller than others. Paint him yellow and add brown spots to make him look like a giraffe.

(Please turn to page 142)



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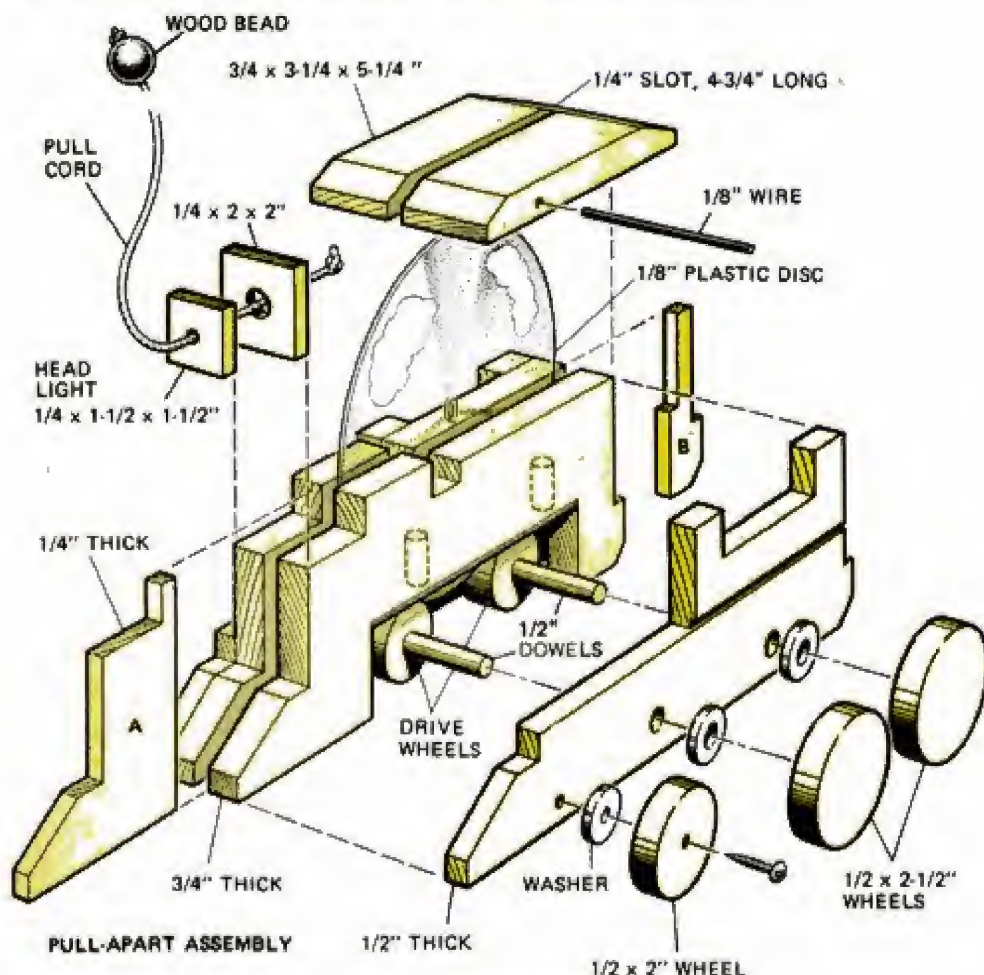
Also available is a Model 702 accessory kit. It includes: 4 turning chisels, 12 assorted 6" hard wood dowels, honing stone, face plate and a wood screw drive center. List price \$15.95.

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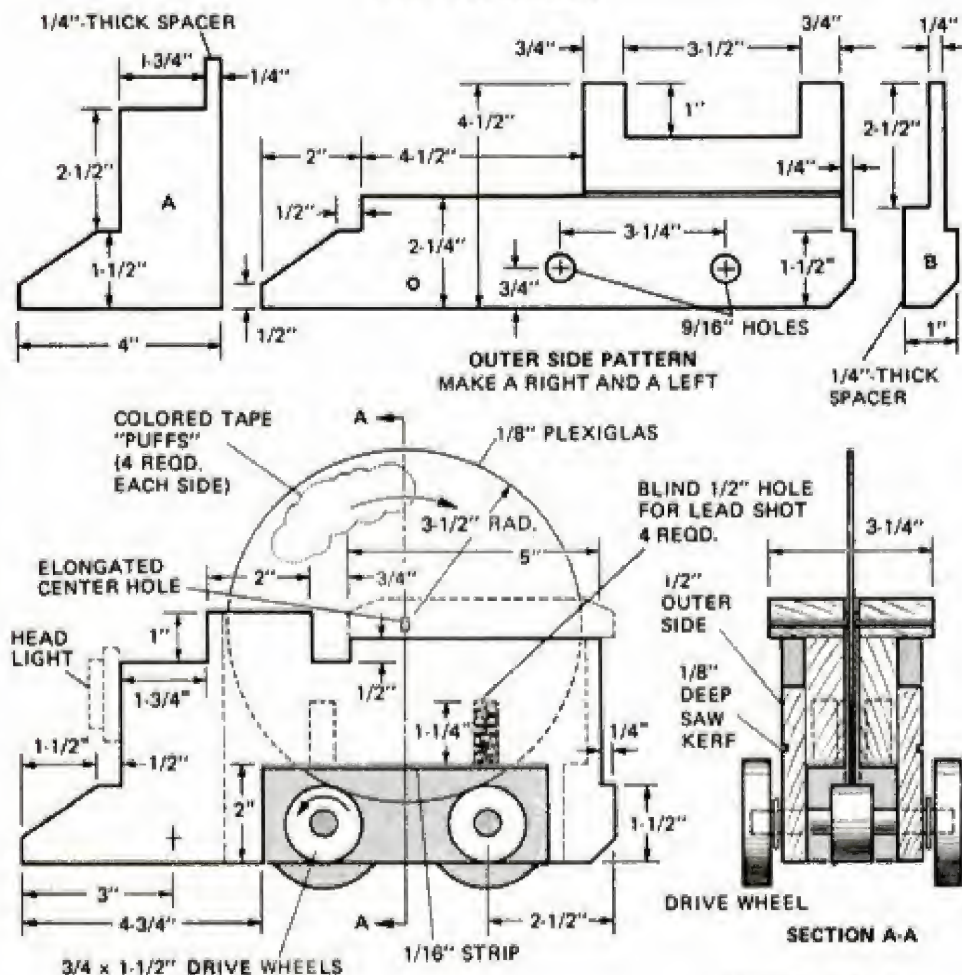
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PUFF PUFF ENGINE



Fast freight from scrap wood

Little guys always like trains for Christmas. The wood-block freight train on the facing page can be made from scrap found in your woodbox. If you plan to make several as gifts, it will pay you to buy a length of 1 3/4-in. wood closet pole and slice the 3/4-in. wheels from it. Likewise a length of 1 3/4-in. stair rail will save time in making several engine boilers and tanks for tank cars. Dowel-and-hole couplings make it easy for little hands to hook and unhook the cars and to interchange them. It's important, of course, that all parts be well sanded and edges rounded, and to use nontoxic paint if you paint the parts.—R.F. Hagerty.

'Smokes' as it rides along

Puff puff engine at the left is a toy which puffs "smoke" as it is pulled along. The illusion is created by a 7-in. clear plastic disc which rests on two inner wheels and turns clockwise when the wheels turn. Four "puffs" of blue tape are stuck to each side of the plastic disc at 12, 3, 6 and 9 o'clock, and a 1/8-in. wire shaft in an elongated center hole holds the disc in place.

The body is a sandwich of five layers, two 3/4-in. thick, two 1/2 in. and one 1/4 in. Spacers A and B form the 1/4-in.-wide slot for the disc. The 1/2-in. pieces are made right and left hand, and the cab's roof is slotted for the disc. Blind holes are made in the four drive wheels and the wheels glued to their axles. Screws are used to attach the front wheels.—Merton H. Slutz.

His mouth is always moving

Opening and closing his mouth as he swims along at the end of a string, Hale the Whale (right) is an irresistible toy small fry will go for in a big way. A wood cam between the front wheels works the mouth up and down as the toy is pulled; 7/8-in. spacer blocks A and B allow free movement for the 3/4-in. pivoted body.

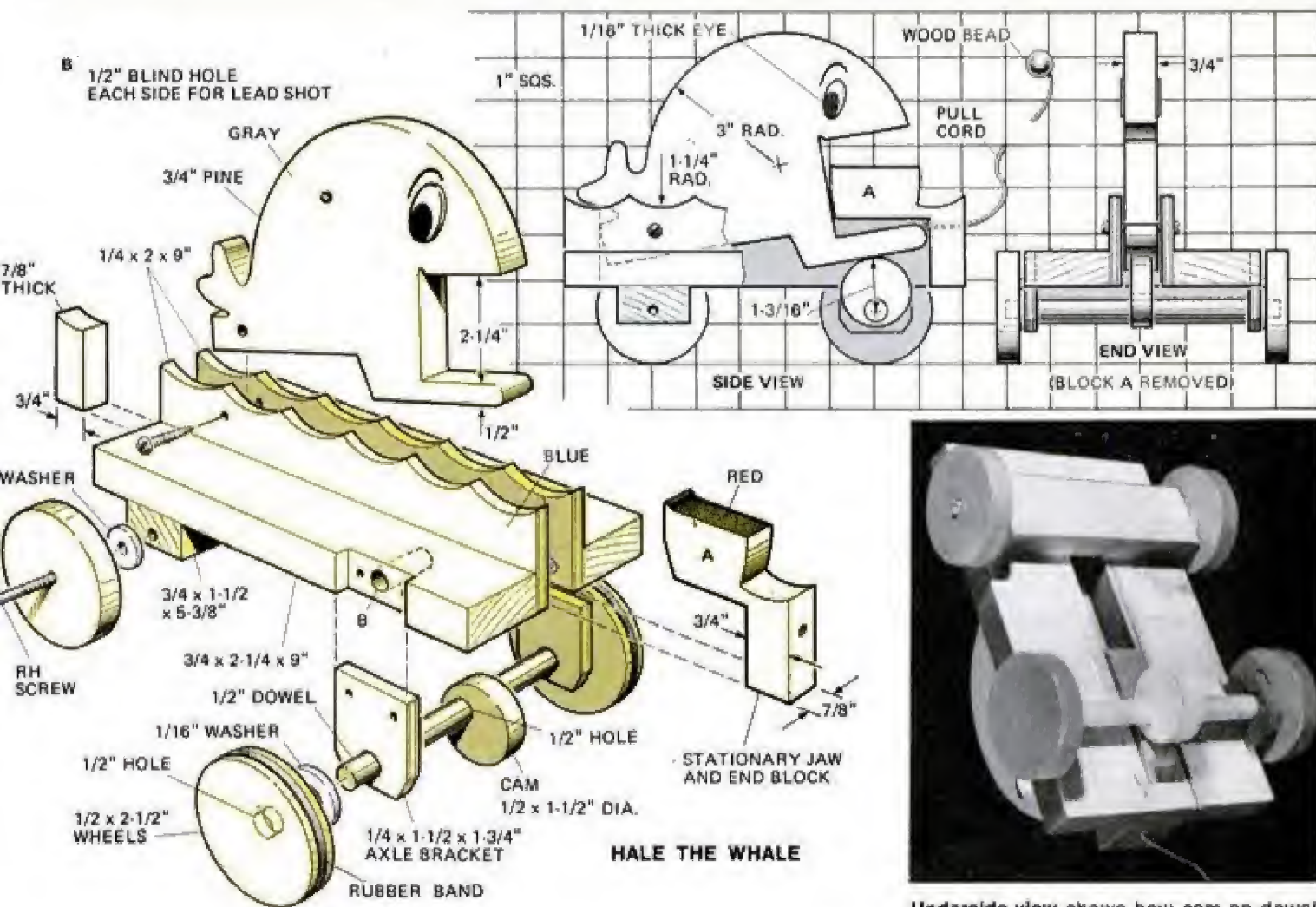
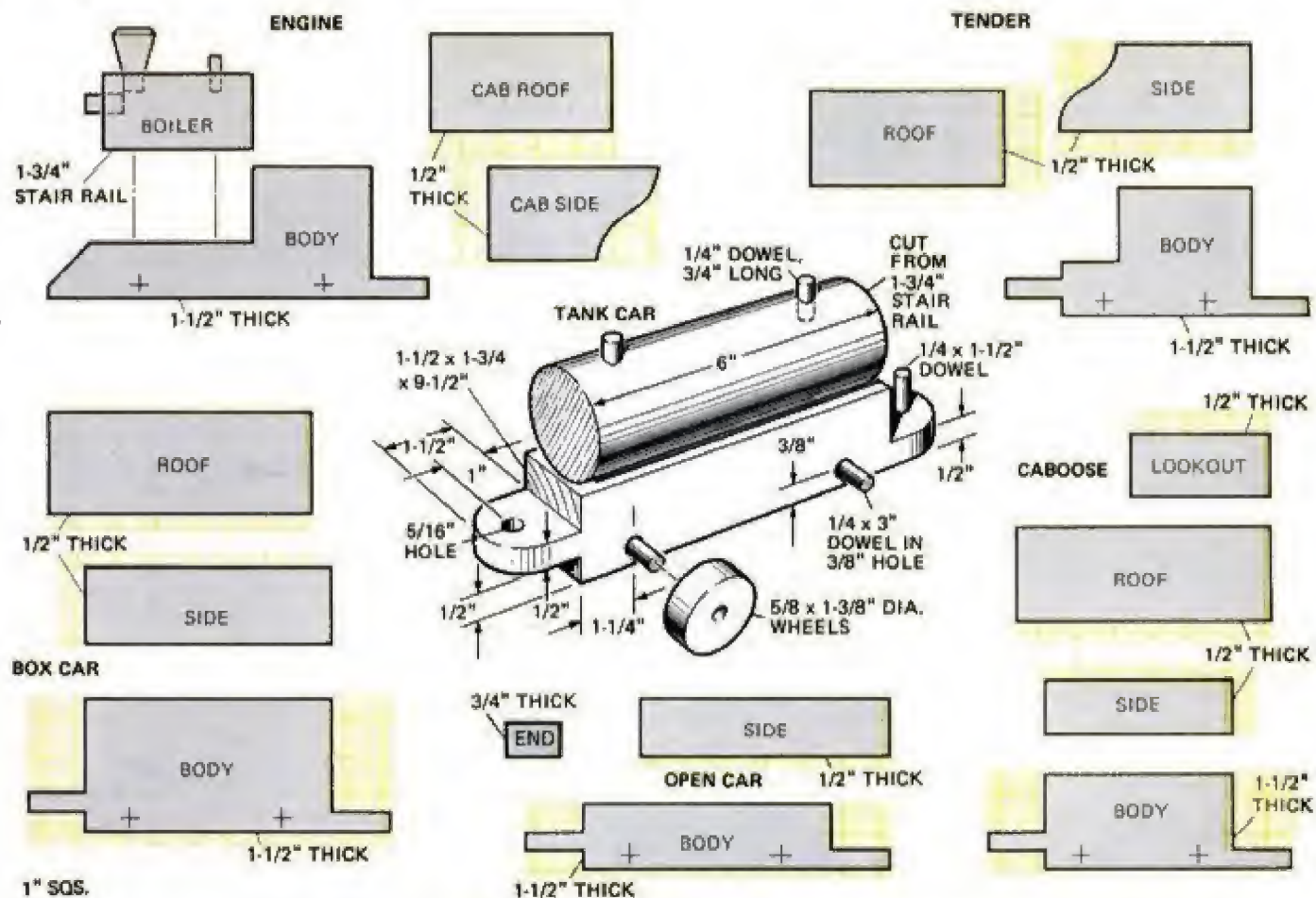
A circle cutter in a drill press will cut the 1/2-in.-thick plywood wheels quickly. Roundhead screws serve as axles for the rear wheels; blind holes in the front wheels fit the dowel axle and the wheels are glued on. Enlarge holes in the brackets slightly so the axle turns freely. Finish with nontoxic paint in bright colors.—Merton H. Slutz.

FREE PLAN AVAILABLE

For a free plan of the whale's body, send a self-addressed stamped envelope to Home and Shop Editor, Popular Mechanics Magazine, 224 West 57th St., New York, N.Y. 10019.

Art: Fred L. Wolff

WOOD-BLOCK TRAIN



Underside view shows how cam on dowel axle opens, and closes the whale's mouth.

I love tobacco. I don't smoke.

**Walt Garrison,
football and rodeo star.**

If I'm a guy who loves tobacco, how come I never take a puff?

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They'll each give you the tobacco pleasure you're looking for.

**Smokeless tobacco.
A pinch is all it takes.**



For a free booklet that explains how to get the full enjoyment of "smokeless tobacco"—as well as a few free pinches that you can try for yourself—write to "Smokeless Tobacco," United States Tobacco Company, Dept. P99, Greenwich, Connecticut 06830.



YOUR FUEL-INJECTION SYSTEM

(Continued from page 99)

mixture, so a device applies increasing counterpressure to push the plunger valve down as the engine warms up. This partly offsets the upward push of the airflow sensor lever and the valve then assumes the position to allow the correct amount of fuel to flow.

This warm-running compensator, is controlled by a temperature-sensitive bimetallic switch, like that used in some automatic chokes. Typically, there are two fuel lines connected to the compensator—one runs to the top of the fuel distributor to apply counterpressure; a second goes back to the gas tank.

The first line contains fuel under the same pressure as in the fuel distributor, and if nothing were done, it would virtually close the metering valve. The compensator, however, lets some of this pressure bleed off by moving a diaphragm to partly block or unblock the fuel lines. Blockage is reduced at low temperatures to bleed off most of the counterpressure, or increased at high temperatures to build up counterpressure and reduce fuel flow to the injectors.

Injection

To maintain constant pressures in the fuel distributor, pressure regulating valves are used. For example, there is a spring-loaded metal diaphragm under the outlet fitting for the flexible tubing to each injector. As fuel flows through the metering valve cylinder slits, it pushes the diaphragm down as far as necessary to increase fuel flow through the tubing to the injector.

The injectors are simple nozzles, although a low-pressure check valve may be built into the injector to keep it from spraying during some low-pressure conditions.

As with E.F.I., the choke may be replaced by an additional injector in the intake-air distributor called a cold-start injector. Typically, it's a solenoid type, operated by current from the starter or by a thermostatic switch.

Other controls

The warm-running compensator is the only counterpressure control used on some cars. If others are needed, however, it's simple to build them in, using the same fuel-pressure bleed principle.

From theory to practice

Now that F.I. has been explained, you can go under the hood and check out the actual hardware. Just turn to page 100. ★★★

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HOW TO KEEP YOUR FUEL-INJECTION SYSTEM WORKING SMOOTHLY

(Continued from page 101)

is a defective thermal time switch or stuck injector. Remove the injector connector, jump the terminals with a voltmeter, crank the engine and if you get a reading, replace the injector. If there's no reading, get a replacement switch (so you know what it looks like), find the old unit in the engine compartment, and replace it.

Manifold-pressure sensor

Cars without the airflow sensor have the less-critical but still important manifold-pressure sensor, and if the engine doesn't seem to have much performance, a defective pressure sensor is possible. To quick-check it, pinch closed the vacuum line to the intake manifold, which should signal full load to the computer. The computer should respond by holding the injectors open longer and the engine will load up and stall.

If the response is negligible, the sensor apparently is bad. On Seville, it's built into the under-dashboard computer, but the hose is accessible under the hood. On imports, the sensor is a separate part under the hood.

Injectors

Current to the injectors is normally of such low voltage it won't turn on most test lamps. On some, however, you may get a faint bulb flicker (Want to try? Pull off the connector and jump the terminals with engine cranking or running).

A failed injector can cause engine misfire, so a more reliable procedure is needed. Here is one: Pull off the injector connector and listen for any difference in engine performance.

If engine speed doesn't drop off, something is wrong. Isolate the problem to injector or wiring connector by turning off the engine and jumping the connector terminals with an ohmmeter. If you get a zero reading, the wiring is good, and the injector should be replaced. With an infinity reading, there is a break in the wiring. Trace and repair.

Idle-mixture adjustment

The intake-air distributor has an air bypass with a tapered needle screw. To lean out the mixture, turn the screw counterclockwise, which will permit more air to bypass the throttle. A similar setup is used on continuous injection.

Continuous-injection system

As with E.F.I., hydraulic continuous injection has an electric pump that buzzes, gas filter and a fuse.

A simple quick-check for basic in-

jection-system performance is made as follows: Remove the wiring connectors from the intake airflow sensor switch and the alternator, which will break a pair of ground circuits that keep the electric fuel pump off except during engine cranking and running.

Remove the most accessible injector from the intake manifold and aim it into a container. The injector may be just a push-fit or held in place by a screw-down retainer, and the fuel lines from fuel distributor to injector are flexible, so there should be no problem pulling and positioning the injector.

Remove the air cleaner or the duct from the top of the airflow sensor, whichever gives you easier access to the airflow sensor plate or lever arm.

Turn on the ignition and lift the airflow sensor plate. On some cars you'll pull up on the plate's hex screw in the center.

As soon as you turn on the ignition, the fuel pump should start buzzing, and when you move the airflow sensor, the system should start spraying through the injectors. Don't play games with spraying injectors. One of those still in place could fill a cylinder with fuel through an open intake valve, and when the engine is cranked, damage could result.

If the injector doesn't spray, repeat the test with the others, and if they work, replace the one that didn't.

If no injectors spray, disconnect the inlet line (from the pump) at the fuel distributor, connect a pressure gauge to it and activate the fuel pump by turning on the ignition. If fuel pressure is close to specifications, the problem is in the fuel distributor, which is replaced as a unit. If there is no pressure or very little, check the gas filter, pump connections and fuse.

Warm-running compensator

The warm-running compensator is the key counterpressure sensor; in fact, it's the only one on most cars with the system. The sensor is mounted on the engine, which transfers some heat, and a wiring connector from the ignition circuit does the rest. The compensator is designed to lean out the fuel mixture on a warm engine, and when it fails, it normally does so in the "cold" engine position, resulting in high fuel consumption and warm engine stalling.

To test it, tee in a 0-100 p.s.i. or 0-6 atmospheres (metric) gauge be-

tween the fuel distributor and the line to the compensator. The gauge shown is a special type that has a shutoff valve to permit measuring system pressure with the single connection, but you don't need it.

With the engine cold, gauge pressure should be low (16-30 p.s.i., 1.1-2.3 atm., depending on the car). As the engine runs, or even just with the ignition on, the counterpressure should rise to more than 50 p.s.i. (3.5 atm.) in a few minutes. When you shut the ignition, counterpressure should drop quickly by about 50 percent, but should hold that lower reading for a full minute, and even after 30 to 40 minutes, there should be a residual pressure of 14-15 p.s.i., or one atm.

If the warm-running compensator doesn't increase counterpressure, check for current at the connector, using a test lamp across the terminals with the ignition on. If the "juice" is there and the fuel lines aren't kinked or leaking, replace the compensator.

Airflow sensor

If the engine doesn't seem to respond under all conditions, check the airflow sensor for free movement. Either pull or push it up (engine off) and you should encounter uniform resistance from the fuel distributor plunger valve. Let the sensor flop closed and immediately try again. This time the sensor should move very freely.

Cold-start injector

Like E.F.I., the cold-start injector in the intake-air distributor is a solenoid type, normally activated by a thermal time switch. To check it, pull the injector from the intake-air distributor and crank the engine. If air temperature is below 50° F., the injector should spray fuel. With the thermal switch, the lower the air temperature, the longer the spray.

Carbon monoxide adjustment

If you have to pass a state inspection for carbon monoxide (CO) emissions, and the car just fails, there is a minor correction you can make by slightly repositioning the adjusting lever on the airflow sensor. Remove the rubber plug from the intake-air distributor (next to the fuel distributor) and insert an Allen wrench. Turning the adjuster slightly counterclockwise (an eighth of a turn) should lower CO.

The typical fuel injection system has a number of less significant components, but we've covered the main things—the things you should know to keep your system working—and working right. ★ ★ ★

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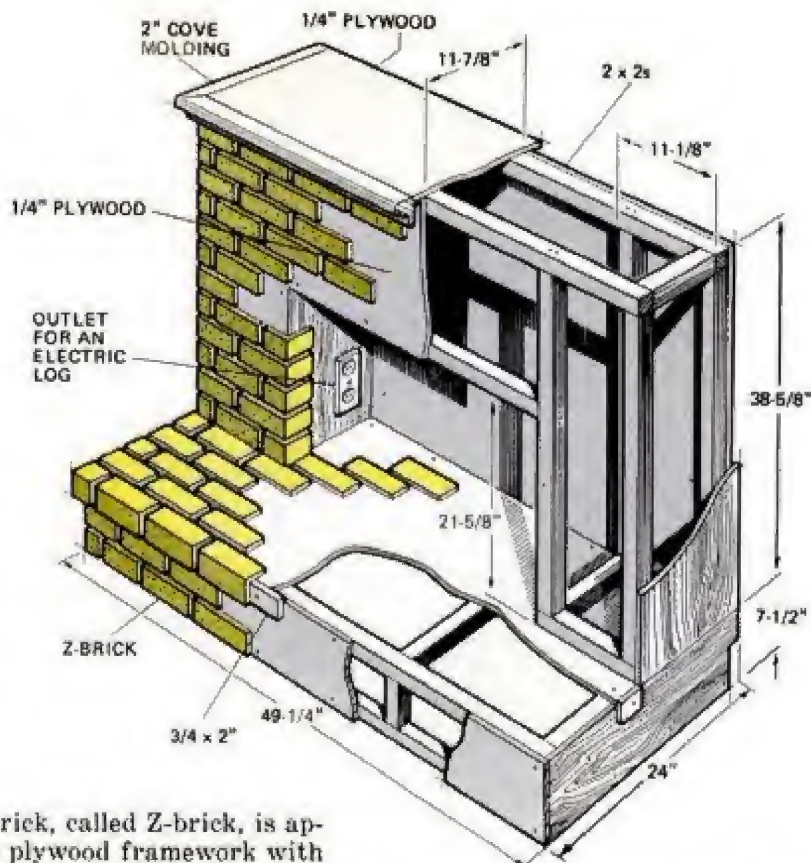
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A step-by-step plan which suggests different mantel treatments and gives a choice of flat or raised hearth, plus information on applying the brick covering, is available for 50 cents from Z-Brick Co., Dept. PM, Woodinville, Wash. 98072

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If your car were properly cared for, as these cars were cared for during the manufacturers tests — your car need break down no more than once a year.

In other words, you might only have to bring your car in for repairs once during the entire year.

You would save the many \$20 to \$60 repair bills you are now paying!

Yes, if your car were properly cared for it would give you perfect, factory-new, high-powered performance the other 364 days a year.

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And most important, these experts have discovered that you do not have to be a mechanic or handyman to coax this peak performance out of your car. Here's why:

5 Minutes A Week For Peak Performance!

These auto industry experts have discovered that your car is a great deal like your body in this respect — that it gives you warning signals before it has a major breakdown.

For instance, when you first got your car, it probably ran perfectly for the first month or so. But then it began to suffer from the vibrations, the jarring effects of normal driving. Then your car might shudder when started — or flood out — or not start at all.

Now — and this is important — if you had the knowledge to quickly make a few minor adjustments — then you could correct these symptoms — you would keep your car running perfectly — and you would prevent major breakdowns in exactly the same way they were prevented in the manufacturer's tests.

If you do not have this knowledge — if you do not make these adjustments — then your car will weaken — and you will get bad performance — you will have to bring your car into the garage for costly repairs.

It's as simple as that. You pay a mechanic — NOT FOR HIS WORK — but for his knowledge. If you had the knowledge yourself — then you would not have to pay him at all.

A survey by three major American insurance companies revealed that average repair costs — depending on the make and model car you drive — go from \$282 a year to \$522 a year. And, the way prices are sky-rocketing, no one has to tell you that these costs may soon double!

Isn't it time you did something about it?

A Master Mechanic At Your Side!

Now suppose that you had a Master Mechanic at your elbow 24 hours a day. Suppose that every time



your car began to give you trouble of any kind — this expert would show you exactly what to do and how to do it.

Suppose that every time you were annoyed by any kind of trouble — this expert would give you an inside, simple-to-follow trick that would solve the problem.

Yes, and suppose that even when your car stopped dead on a cold snowy night, this expert would give you the mechanic's secret that would get you home speedily and in perfect safety.

The Facts You Need To Save Big Money!

This is EXACTLY what a new, easy-to-follow book, "How To Get Peak Performance From Your Car" will do for you!

It makes no difference what make or model car you drive — it makes no difference if you are a man or woman — if you have absolutely no technical know-how — even if you don't know the difference between a carburetor and a fuel pump — YOU can learn to make the minor adjustments that will guarantee you a smooth, factory-perfect ride — every day of the year.

The auto experts who have prepared this do-it-yourself-with-easy guide to trouble-free driving have taken out all the technical language — all the mechanic's mumbo-jumbo — and give you the easy-to-understand, step-by-step tips, guidance, short-cuts and facts you need!

Just imagine how your friends and relatives will be amazed to discover that you know:

- ** A simple technique for starting your car when your engine is flooded.
- ** How to start your car when your battery is dead as a door nail.
- ** What to do when your engine overheats.
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- ** A mechanic's trick to give you maximum gas mileage.
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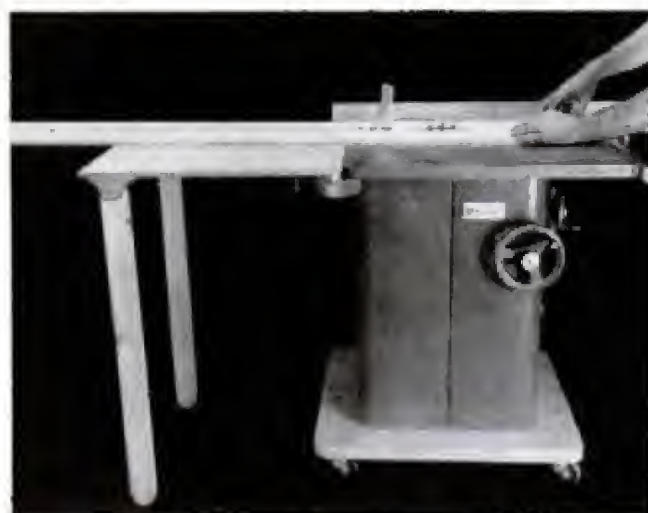
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This roller support can be made of scrap, but does require a sawhorse and C-clamps. A 1-in.-dia. dowel is supported by blocks glued to 1x4 posts which are clamped to the horse so they're level crosswise and even with the saw table. Dowel is sanded down at ends so it turns freely.



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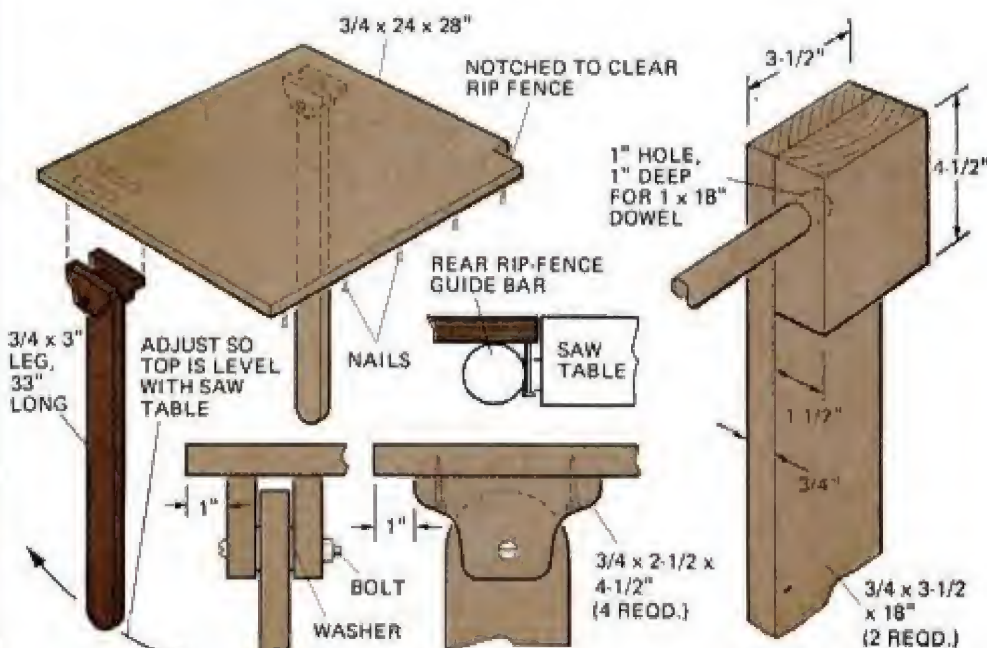
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Struggling to hold a long board single-handed when you rip it on a table saw is not the best practice for either safety or ease of handling. Either of these "helping hands" will prove a valuable aid.

One is a roller affair attached to a sawhorse with C-clamps and the other is a two-legged plywood table that

hooks over the saw's rear rip-fence guide bar. The friction-fit legs swing to bring the top even with the saw table, and to adjust to an uneven floor. Pick a straight dowel for the roller support and sand the ends so it turns freely as it supports the work. Both take little space to store.—Rosario Capotosto



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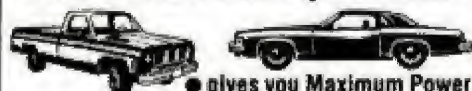
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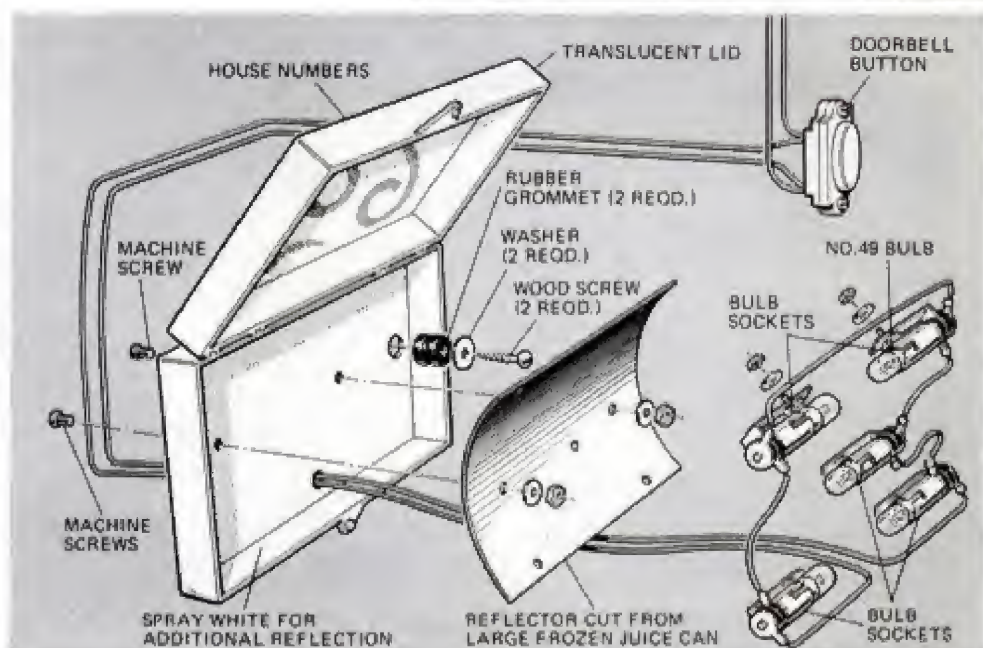
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Your house number belongs in lights

by Rudolph F. Graf
and George J. Whalen

Photo: Michael Zarembski



Ever wander down a strange, dark street peering at invisible house numbers to find the address you're after? Your guests won't have that problem if you illuminate your house number—and you can do it without running new wiring.

The trick is a low-voltage lighting system that draws its power from your doorbell's transformer. This circuit is always on, and its wiring comes right out to the bell button, where it's easy to tap into. The bulbs are No. 49 "flea-power" types (Lafayette 32 F 66210) requiring only 60 thousandths of an ampere each, at two volts. Use five bulbs in series for a 10-volt bell circuit, eight in series for a 16-volt chime setup.

While the wiring to the doorbell button may appear to be only a switch loop, what you're actually doing is drawing power through the bell circuit—just enough to light the bulbs, but not enough to activate the bell. When the button is pressed, the light will momentarily go out and full power routed to the bell will ring it.

Choose a plastic box big enough to hold your house number. If its lid is transparent, make it translucent with a light spray of white acrylic paint to diffuse the light. The numbers can be plastic or metal.

The reflector assembly is cut from a 12-ounce, aluminized-cardboard frozen-juice can. The miniature bayonet sockets (Lafayette 32 F 28038) are bolted to the reflector as shown in the drawing.

Wire the bulbs in series and run the wire through a hole in the box; knot the wire inside so the connections won't loosen if the wire is yanked, and leave enough wire outside to reach the doorbell button.

The bolts that hold the reflector to the box, and the screws holding the box to the wall, should pass through washers and rubber grommets, so the box won't crack when you snug up the screws. The wires to the doorbell button can run inside or outside the house, or even run safely underground to a post or tree nearer the street.

★★★

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1800 Via Burton, Anaheim, CA 92805

Before Fluidmaster, John was a pain in the ear.

ZERO-IN FOR HUNTING

(Continued from page 81)

in their normal offhand position. Less practiced handgunners tend to spray their shots too widely for a useful group and need to use a rest. Sitting is one of the most convenient positions and should let you extend the gun at almost full arm's length so the sights will look the same as when you're shooting offhand.

Sit facing directly toward the target, draw your knees up about halfway to your chest, take a two-hand hold on the gun with the nontrigger hand underneath the butt, and rest your elbows on the inside of each knee. Fire five-shot groups, using the center as your zero point. Then adjust your rear sights as you would for a rifle, moving them in the same direction you want the bullet to move.

Shotguns

Your shotgun doesn't have sights in the normal sense and is pointed rather than aimed, but it must hit where you look. Rather than adjusting sights, you need proper fit.

Pace off a distance compatible with your shotgun's choke—40 yards for full choke, 30 for modified and about 22 yards for improved cylinder. Then put up a large sheet of paper with a dark mark in the middle. Mount your shotgun as you normally would afield and fire at the mark. The resulting pattern should spread evenly around it in a rough circle. Several shots and sheets of paper should give you an average.

If your patterns are too high, your stock may be too straight for you or too long. If the patterns are too low, your stock may have too much drop, (the measurement from the middle of the top of your stock to a flat surface against which the top of the barrel and receiver are held). Generally, standard field stock dimensions will fit most shooters with sleeve lengths between 31 and 33 inches.

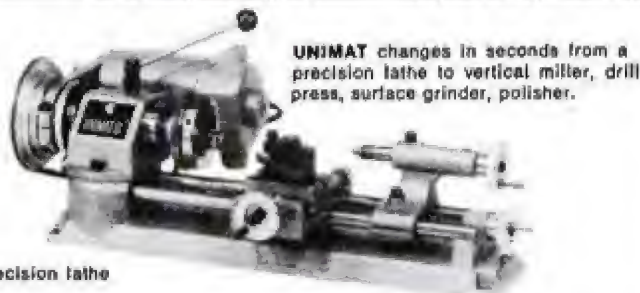
A gunsmith can shorten your stock if necessary, or lengthen it by adding a recoil pad and butt spacers. He can also alter the amount of drop if this is a problem. When a shotgun shoots consistently to the left or right, it may mean the shooter is not mounting it so that he is looking straight down the barrel. Occasionally, this can also result from a barrel that has been bent or damaged. A gunsmith can check this out for you.

A properly fitted shotgun is the same as a correctly zeroed-in rifle or handgun. Always take time to make sure the gun you use is zeroed-in. The reward will be a higher percentage of shooting success. ★ ★ ★

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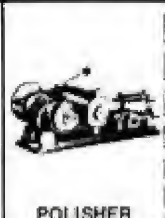
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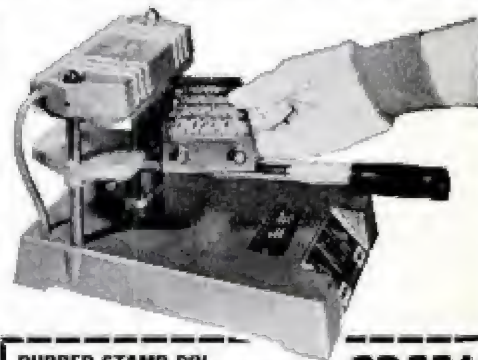
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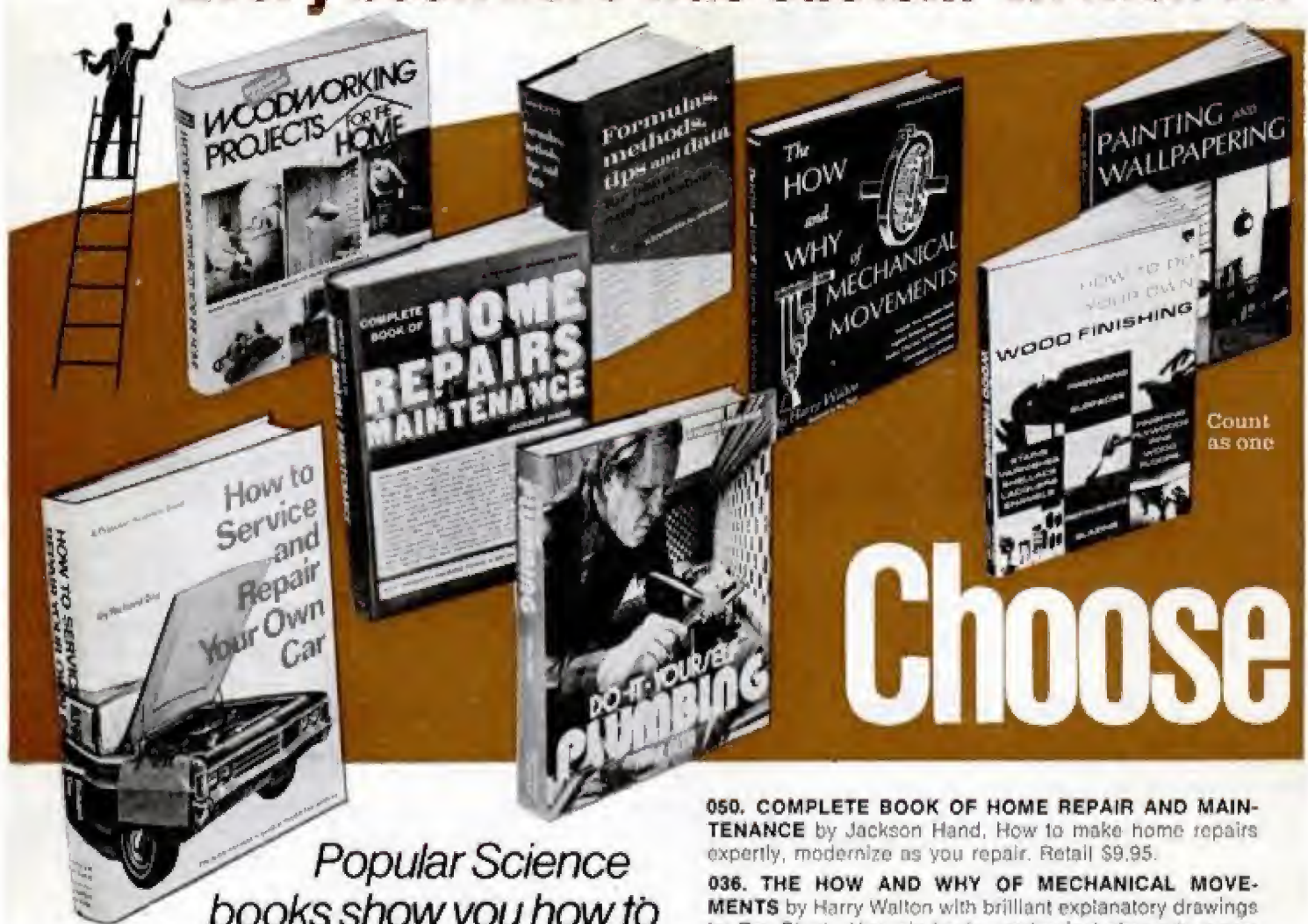
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VANS HAVE A LOT MORE GOING!

(Continued from page 71)

refrigerators, but you'll seldom see chairs except in the driver's compartment. Most people prefer the floor, yet one owner insisted on oversized king and queen thrones. As one decorator said, "Do your thing and be as outrageous as you like. Only your friends see inside."

Since the customizing idea originated in southern California, it is logical that some of the best-known interior specialists are headquartered there. Creations of T & H Vanworks Unlimited, in North Hollywood, range from a nautical version with authentic portholes and ship's clock, to Ten Grand, an opulent concept with hand-worked wood paneling. HI Enterprises in Garden Grove recently completed the Bunny Kart,



Photo: Norton Pearl

When singles convert to family activity, van can too with modifications offered. This Dodge Bizi-Bodi alteration for winter-summer has airconditioner, extra heater.

a showpiece with customized cockpit and interior of deep velvet with white shag carpeting plus wall and ceiling mirrors.

Outside art can vary from colorful abstracts and cartoon characters to add-on decals. Mike Love, owner of Custom Paint Specialties in Riverside, does one-of-a-kind paint jobs, has flown around the country on assignments, and is noted for a "smoke effect" achieved by actually burning paint with a torch. Among accessory producers, HI Enterprises has a heavy-duty rear door and ramp for loading cycles and snowmobiles; Pacer Performance offers upholstered furniture for vans; Duffy's Enterprises has an easy-to-install sunroof. Custom Van Co. conversion kits range from \$169 to \$675. Red-E-Camp and Hop Cap do the whole job, with completed vans from \$5000 to \$7000. Even Sears Roebuck has a catalog of do-it-yourself items. For

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back-country types, a four-wheel-drive van is constructed from the ground up by Pathfinder Equipment.

Carmakers, too, are cashing in. Dodge has a special Tradesman with rear porthole windows, plus special plush decor. Ford is pushing its new redesigned "third generation" Econoline as a van with conversion possibilities. San Jose van specialist. Bizi-Bodi, reported this summer it couldn't get delivery on all the hundreds of new vans it was ordering.

One van bumper sticker says, "Don't laugh, your daughter may be inside," but another young Los Angeles owner explains it better: "Vans are a way of life, complete vehicles no matter what your bag. Pickups and four-wheel-drives rush out of town for back country or a beach, the only place they shine. Man, my rig is right, wherever I am." ★★

ALL OUTDOORS

(Continued from page 32)

face backstops for patterning steel-shot shotshells are not recommended because of the chance of hazardous pellet bounce or ricochet.

And, of course, dental damage can result from biting on any type of shot pellet, so you should be careful when eating game bagged with either lead or steel shot.

Several million shooters enjoy the money-saving skills of handloading, but because of the danger of gun-barrel damage, they should follow special precautions with steel-shot loads or stick to manufactured shells.

New and neat

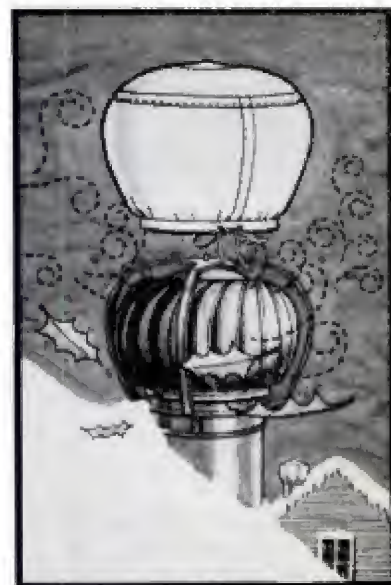
Among outdoor items recently introduced, we've noticed several that look good, useful and different. Garcia has an over-and-under, no-frills utility gun with a skeleton stock of metal and a weight of only 4½ pounds. One barrel takes .22 cal. and the other .410 shotgun shells, and the gun takes down for easy packing. As a camping and survival weapon, it appears particularly suitable.

Winchester's old favorite Model 12 slide action is available in a special limited edition of 800 as a Ducks Unlimited Commemorative. Beautifully finished, it's a worthy gun for a worthy cause.

Heddon has added power and backbone on its fly-rod line with the introduction of a Steelhead-Tarpon-Bonefish model to take on the tough ones. A nine-footer, it should be popular with open-water sportsmen.

Olympic International has a reel (Please turn to page 162)

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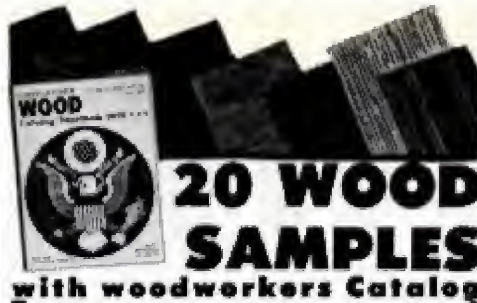
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ALL OUTDOORS (Continued from page 161)

for fresh and saltwater spinning that shifts gears automatically when the going gets heavy. A 5.1:1 gets the line in fast, but when a lunker hits you feel an instant downshift to 2.83:1 retrieve, and the fish wonders who turned on the power drive.

A solid pewter plate with inset four-color tile giving the Second Amendment's right to bear arms is \$45, or \$6.75 postpaid for the tile alone from Bob Wallack, Liberty Gallery, 35 Robinson Ave., Attleboro Falls, Mass. 02763.

Bad-weather bonus

This time of year when a rainy weekend keeps us indoors, there are a lot of excellent new outdoor books to catch up on. Some are available at book stores and sporting goods departments; others can be ordered directly from the publishers.

Many outlets that carry Coleman camping equipment also sell the \$1 booklets called *Coleman CampSense* and the *Coleman Camping Trailer Guide*. They are illustrated with Coleman products (no surprise), but the texts are noncommercial and filled with particularly useful tips, checklists and reference material. The pages of addresses of tourist information headquarters for each of the 50 states plus neighboring Canada and Mexico are worth the price alone.

Want to make fishing a family affair? A booklet called *Fishing Facts for Female Anglers*, by Jean Lovetang, tells painless ways to get wives and children started, is published by the St. Croix Tackle company and is found at their dealers or can be ordered by mail from St. Croix Corp., 9909 South Shore Drive, Minneapolis, Minn. 55441.

Fly Fishing for Backpackers is a pocket-size 96-page guide that is \$2.50 at Fenwick tackle dealers or postpaid from the company at Box 729, Westminster, Calif. 92683. It has good coverage of the basics of both sports and describes how best to combine them.

Winter maintenance of your outboard motor is easier with the *Complete Guide to Outboard Motor Service and Repair*. In paperback, it's \$6.95 from Tab Books, Blue Ridge Summit, Pa. 17214. Along with well-known makes, it covers older models and brands, including Tecumseh, Wizard, Sea King, Husky, Mono, Barracuda, Clinton and British Seagull. Theory, mechanics, fuel economy, high performance, matching hulls and props are also among subjects covered. ★★

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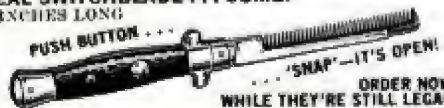
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TOM MCCAHL SAYS: "The appliance repair field is so uncrowded it's almost lonely!"



Someone once said that if you build a better mousetrap, the world will beat a path to your door. In the home appliance business, a lot of enterprising companies have gotten rich peddling a long list of handy electrical gadgets for the home. The trouble is, the two dozen or more appliances in the average American home can go on the fritz, and men with the proper training to do repairs are as scarce as plumbers on weekends.

Good Appliance Repairmen are a rare breed these days. Those with a little ambition are booked so solidly you can wait days to get somebody to fix a balky refrigerator or cantankerous toaster. Sometimes, you have to settle for a bum job from a guy who had no business calling himself an Appliance Repairman in the first place.

This brings me to my point. If you want to make money in a field that's begging for trained technicians, there's a fine, low-cost home-study plan available that teaches you how to handle every type of Appliance repair in detail—including refrigeration, air conditioners, and even small gas engines. The course was prepared by the instructors at National Radio Institute. This is the oldest and largest home-study school in the Electronics/Electrical fields with more than sixty years' experience training men like yourself for new careers or spare-time or full-time businesses of their own.

A few years ago, NRI recognized the increasing demand for trained Appliance Repairmen. They set about preparing well-illustrated, easy-to-understand lessons that teach you how to repair home, commercial and farm Appliances. NRI even added a professional Appliance

Tester that's included in their low tuition. With the Tester and a few basic tools you probably already have, you're equipped to service most Electrical Appliances. If you aren't making \$5 to \$7 an hour in spare time fixing Appliances for friends and neighbors within a few months after enrolling, my name isn't McCahill.

The reason I'm no doubting Thomas, is because the staff at NRI is composed of experienced instructors who guide you through the course with more personal attention than you'd get in many classrooms. With the kind of help they give a student and the kind of course they have, you can be the man in demand in this field—even if you've never rewired a plug, or got fed up with school at the 9th grade.

The best advice I can give you is to clip the coupon below and send for the NRI Appliance Training Catalog. It's free, and there's no obligation. NRI doesn't employ salesmen, so nobody will be knocking at your door. All it will cost you is a postage stamp. Take it from Uncle Tom, the Appliance Repair field needs good men. Now.

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Tom McCahill



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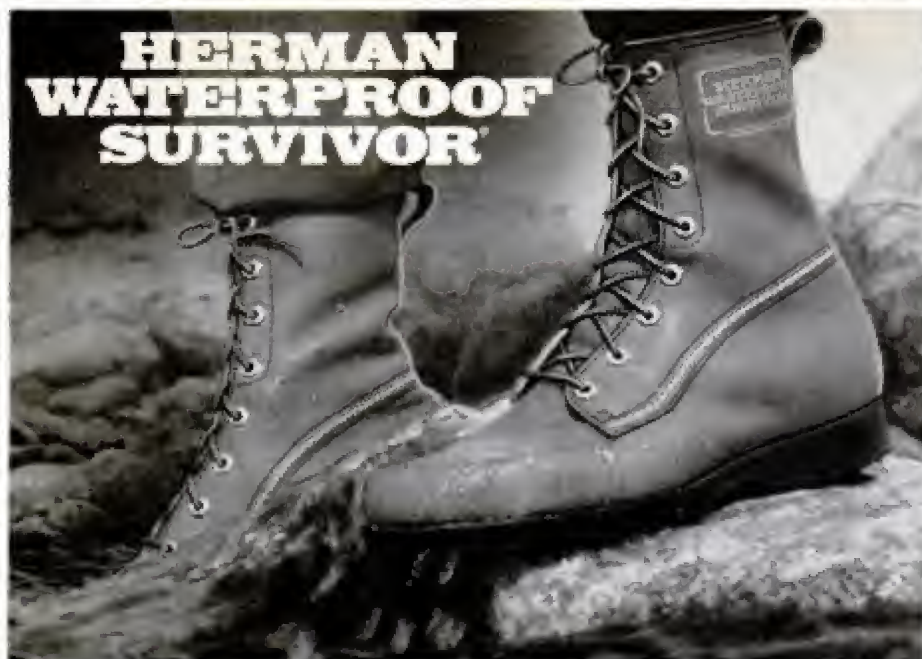
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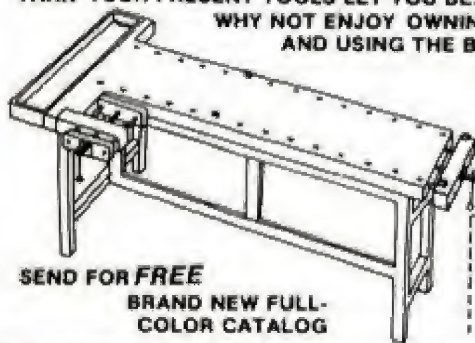
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LETTERS

(Continued from page 12)

on extras like radio or something else. I would rather have the job done right. If something doesn't work right the dealer will fix it. I would rather pay \$1000 or more. If people want to save more money why don't they buy a car without an engine and without tires. They could install it themselves by your articles. I really think the writer has a dumb idea.

BURNARD BLUEGRASS
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'Pull up' alarm

The sad part about the TWA flight 514 (*New 'Pull Up' Howler Makes Your Flight Safer*, page 74, July '75) is that five years ago the airline could have purchased and installed the Ground Proximity Warning System. The airline's cost would have been less than and nearly a hundred persons would be alive today!

BROTHER CLETUS COOK
WAKEFIELD, OHIO

Overlooked front-wheel drive

How to Stay Alive in a Small Car (page 39, Aug. '75) was interesting and informative, but left out one item which has been overlooked in every similar article I have read.

The paragraph on controlling a car is applicable only to rear-wheel-drive vehicles. There are many front-wheel-drive vehicles on the road; it would be a disaster to turn the front wheels into a skid in such a car.

You should point out that a front-wheel-drive car handles entirely different from a rear-wheel-drive car, and when the rear end skids, you should hold the steering wheel still and add power. If the front end skids, just reduce power.

EARLE GARRETT III
DANVILLE, VA.

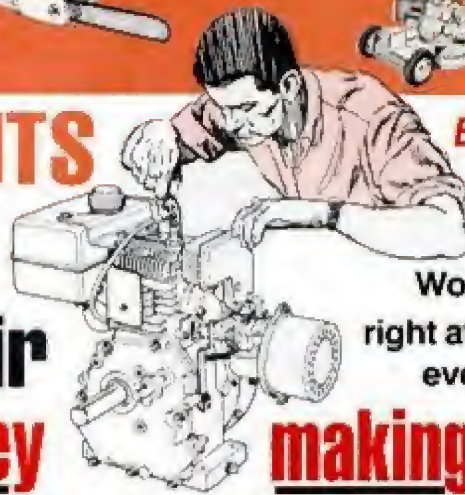
Correct! We tried to make the article apply to most readers—but we should have added your warning for drivers of front-wheel-drive cars.

I was very pleased to be able to identify with Bill Hartford as I have driven small cars (Corvairs) since 1960. Indeed, the small car can be fun and economical, but you do have to be a full-time driver as Mr. Hartford explained so well. I often miss the scenery as I am so busy driving. When I got my motorcycle, I eagerly set forth to see "what you cannot see from a car." But soon I found if driving a small car requires 100 percent attention, the motorcycle requires 200 percent.

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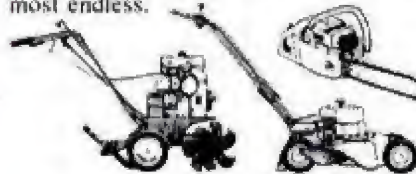
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TRANSATLANTIC BALLOON JINX

(Continued from page 103)

The U.S. Coast Guard was notified. Soon a plane was on the scene and in communication with Sparks. At 6:50 p.m., about 125 miles southeast of Nantucket, with a Coast Guard helicopter standing by and a cutter on the way, Sparks brought the *Odyssey* down. On ditching, the balloon necessarily was released. Sparks and Hadden Wood were picked up and the gondola, previously used in the 1973 *Yankee Zephyr* flight, was saved to fly again.

Rip cord may have been pulled

What caused the leak? Both Bob Sparks and the balloon's designer/builder, Mark Semich, believe the rip cord was inadvertently pulled as the envelope was handled during inflation leaving the rip panel open just enough for gas to leak out slowly.

Balloons are provided with a rip panel for quick deflation during landing. One gore of the envelope has a series of openings through which gas can escape. Cemented in place inside the balloon, the rip panel covers these slits. The rip cord, fastened to the upper end of the panel, near the top of the balloon, hangs down inside and extends out of the appendix at the bottom of the envelope. When the cord is pulled, the rip panel is torn away, exposing the slits.

The empty envelope is an unwieldy mass of heavy fabric, rather like a very large tent. It's easy to see how, as is suspected, a volunteer helper might have grabbed the rip cord, inside the bag, along with handfuls of cloth; then, in lifting and moving the balloon, the cord was unknowingly pulled.

Ironically, fine flying weather prevailed over the Atlantic Ocean for the five days after takeoff, in which time the 30-knot winds could have carried the *Odyssey* to the British Isles. Hadden Wood's uninvited presence aboard would not in any way have jeopardized the safety or success of the flight.

He'll try again next year

I spoke with Bob Sparks soon after his return. His first words were "I'm disappointed, but I'm going to try again next year. I owe it to me." He has no hard feelings toward Hadden Wood, an old friend, but says he could never work with Wood again.

Undaunted by two failures, Sparks now is making plans for a summer 1976 transatlantic balloon flight. He has offers of financial support and already has sanction from the National Aeronautic Assn. for attempts at the world records for distance and duration this flight would set. ★★

PHOTOGRAPH BY MICHAEL GOODMAN FOR POPULAR MECHANICS

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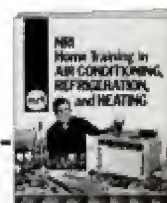


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Wen's new 2-speed saw reciprocates



Used at low speed, 5-in. metal-cutting
blade (above) zips through angle iron,
and pipe up to 2 in. Smooth plunge
cuts (below) are made quickly in plaster-
board, wood with special 6-in. blade.



When I picked it up for the first
time, I had my doubts about
Wen's new lightweight two-speed re-
ciprocating saw. It just didn't seem
to have the heft and feel to live up to
the manufacturer's claims, particu-
larly when cutting steel. I was in
for a surprise, however, for I found
this versatile portable saw wasn't
about to say "Wen," whether cutting
steel or a 4x4.

I did find that controlling its two-
speed motor came with practice as
the least extra squeeze on its trigger
can put it into high speed (3000
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be in low speed (2200 spm). You
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plunge and flush cuts, and its three-
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lefties. The saw sells for \$39.95 at
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Home and Shop Editor



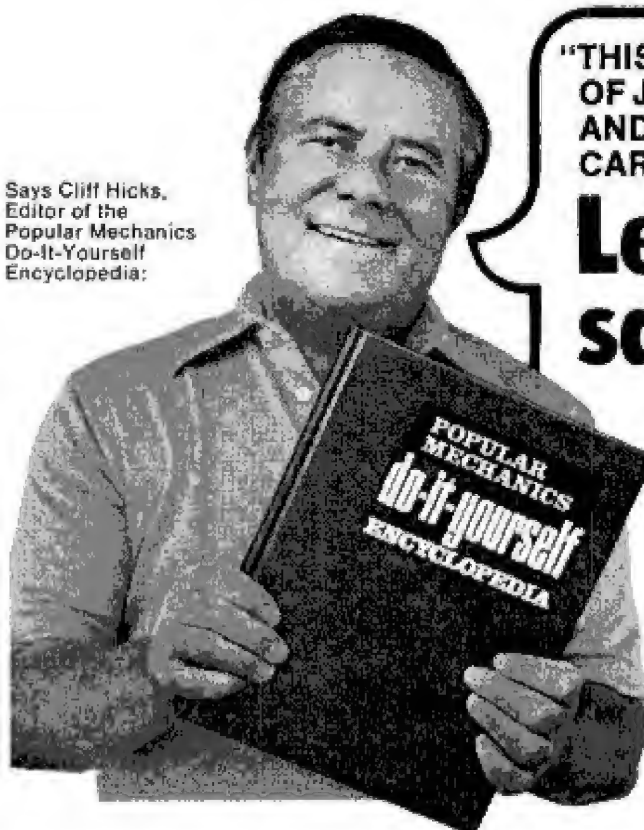
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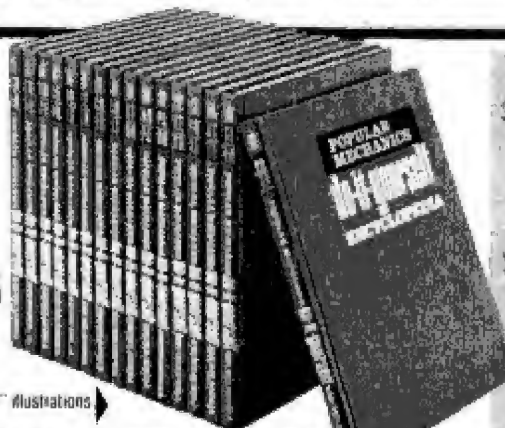
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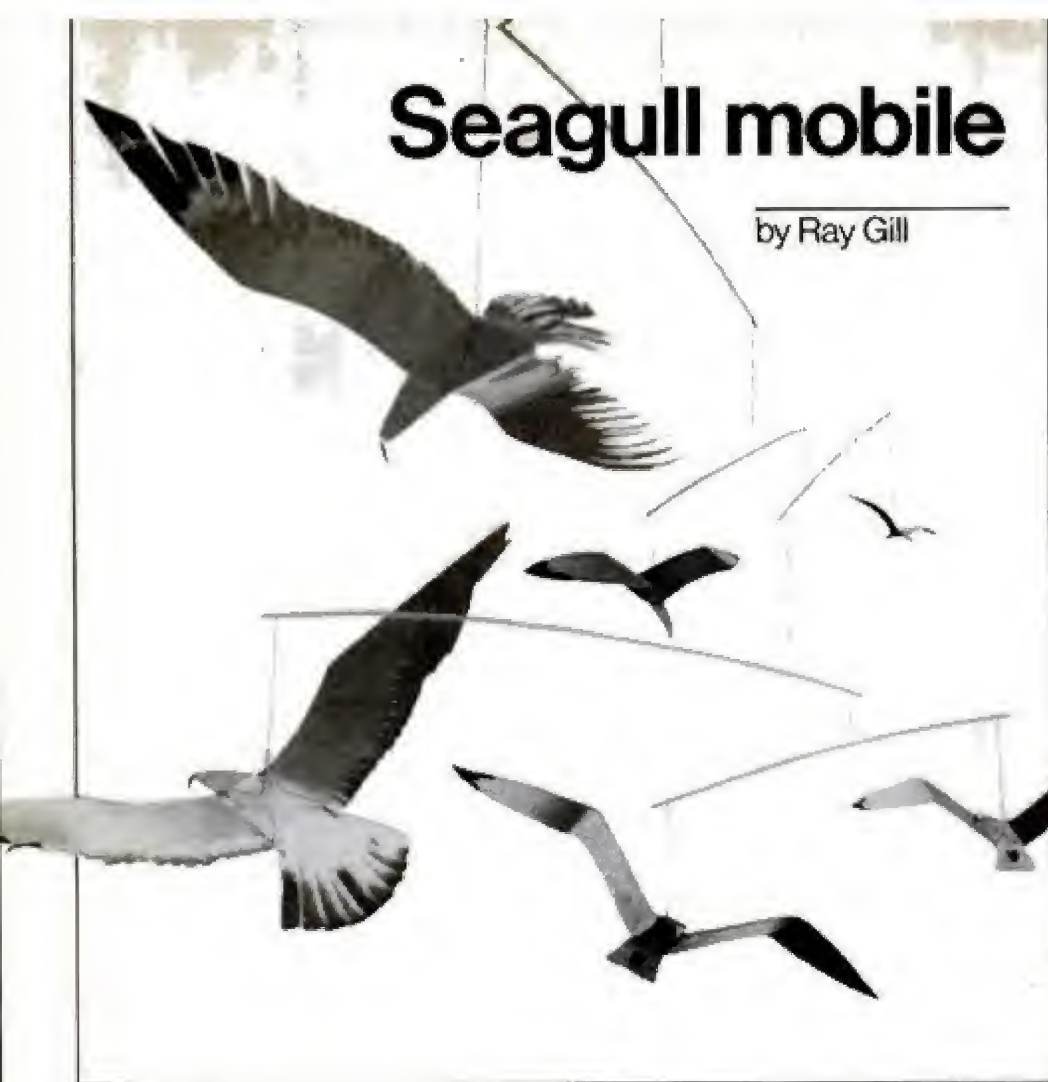
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Seagull mobile

by Ray Gill



This delightful, breeze-sensitive mobile is easy and inexpensive to make. Large and small seagulls are cut from the stiff sheet aluminum sold in hardware stores for about \$4.50 for a 3x3-ft. piece. Metal snips or household shears can be used, but the aluminum cuts best on a hobby jigsaw—tape the metal to plywood scraps, to prevent rattling. Cut the pattern shown on the opposite page from paper or cardboard, and mark the feather-cutting line with a felt-tip pen or grease pencil. Cutting feathers will produce a natural curl; make it match on both sides.

For stability, each gull has a stiff wire hanger twisted around the body and secured with metallic glue. The upright part of the hanger should be longer when wings are bent upward, as in the third photo opposite. The end loop of each hanger should be about $\frac{1}{4}$ in.

higher than the highest parts of the wings. For the smaller birds, hanger wires can be attached to plywood rectangles which are then fastened to gulls' bodies with epoxy.

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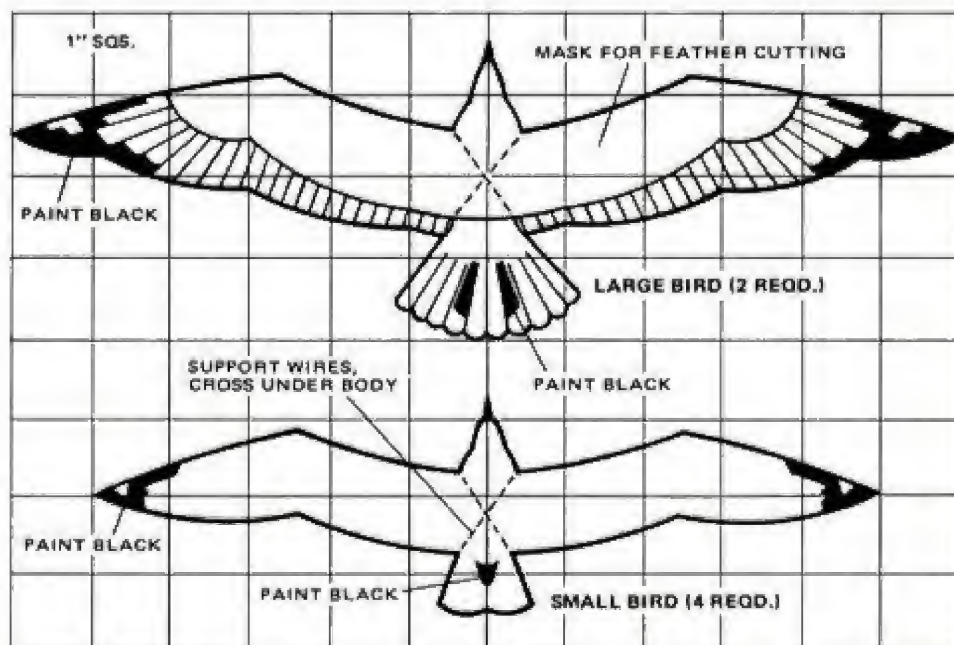
Two wires twisted together make the completed hanger.

Simpler hanger can be epoxied onto smaller gulls.

colorless nylon thread, and knots are fixed to the rods with quick-drying glue (make sure that all oil is removed from the rods so that the glue will hold).

Assemble the mobile like this: Start at the bottom and attach both larger birds to the ends of the first rod with short lengths of thread. Find this rod's balance-point and fasten thread to it. Fasten the other end of the thread to one end of a second rod. Attach a small bird to the other end of this rod, find the balance point and proceed on up. Tie the top thread to a small metal ring, to hang the mobile from a cup hook in the ceiling.

Hang the mobile at least 3½ ft. away from walls for free action, and high enough that the wheeling gulls won't poke passers-by. ★★★



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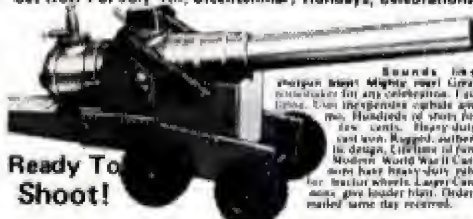
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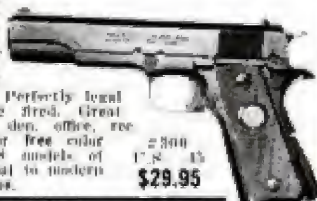


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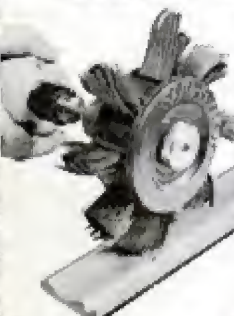
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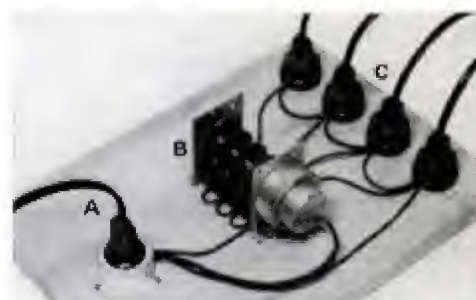
Outdoor tree lights along eaves, doors and windows and hooked up to sequence timer outline home with dazzling "traveling" lights during holidays.

Ever been fascinated by the moving lights on a theater marquee? You can outline your home this Christmas with similar "traveling" lights by a simple motorized switching unit which produces a series of on/off flashes in a sequence that gives the illusion of "running" light.

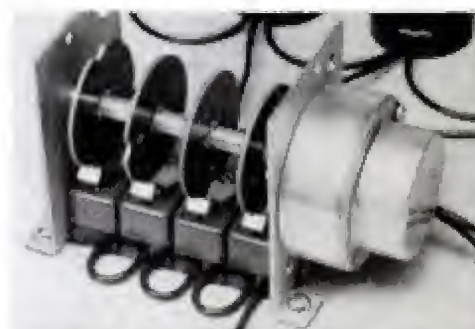
The heart of the breadboard-mounted control center is a small slow-speed timing motor driving a bank of four cams. The programmed cams momentarily deactivate a like number of closed Micro Switches at the rate of about one blink every 3/4 second. The cams are positioned on their shafts so that each 1/4 revolution of the 20-rpm motor actuates a different switch. Four separate circuits are used to achieve the animated effect; hence the four Micro Switches.

Multiples of regular outdoor Christmas-tree light strings comprise the circuits, but each circuit must contain the same number of bulbs. The lights are arranged on the house so that every fourth bulb is connected to the same circuit. Simply put, when connected in series with the appropriate Micro Switch, the result is that three adjacent circuits are energized simultaneously, while the fourth is, for a split second, de-energized. As successive switches are actuated, the pattern of light and darkness repeatedly advances along chain of bulbs in a rippling fashion.

Ideally, of course, the light sockets should first be mounted and spaced uniformly on wooden strips such as lath to simplify "stringing" the



Light strings are plugged into four base sockets (C) of cam-and-switch bank (B). Power is brought to male connector (A).



Parts of four low-cost switch banks are used to rig one unit with four same-size cams which trigger the Micro Switches.

lights along the eaves. Keep the lights close together and use lots of them for the most impressive display.

The switch-bank-and-motor combination shown is a unit I modified after purchasing it from Newark Electronics, 500 North Pulaski Rd., Chicago, Ill. 60624. By employing a motor of different speed, the pace of the light movement can be altered accordingly.—Charles Oswald.

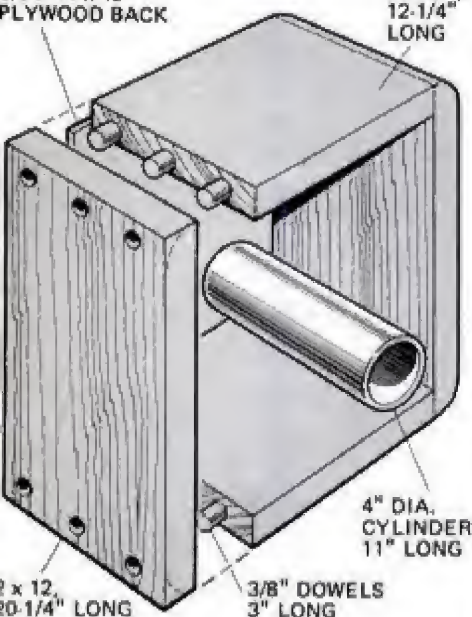
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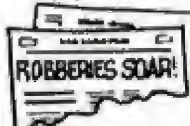
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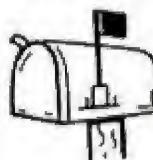
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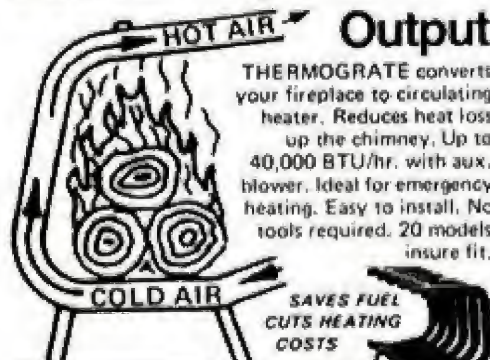
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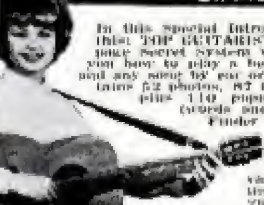
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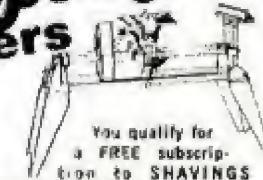
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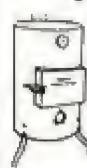
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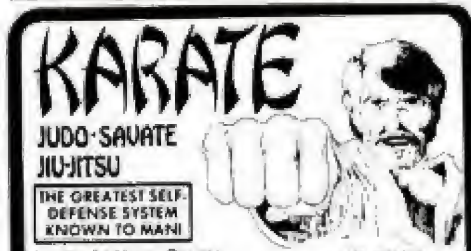
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(Continued from preceding page)

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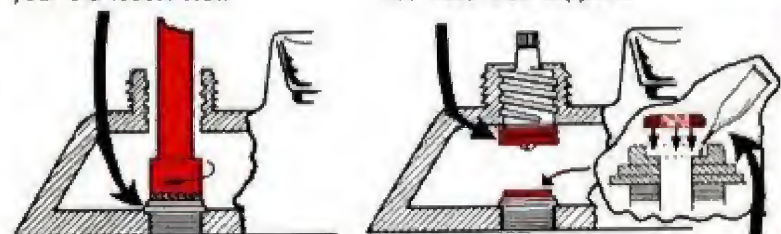
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